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WORLD CROPS

The International Journal of Agriculture

VOLUME 13, No. 7 JULY 1961

Typical symptoms of boron deficiency in lucerne are the yellowing of the upper leaves, stunting of the upper stem and reduced flowering. For information on the prevention and cure of boron deficiency in lucerne see page 250

Photo: Borax Consolidated Limited

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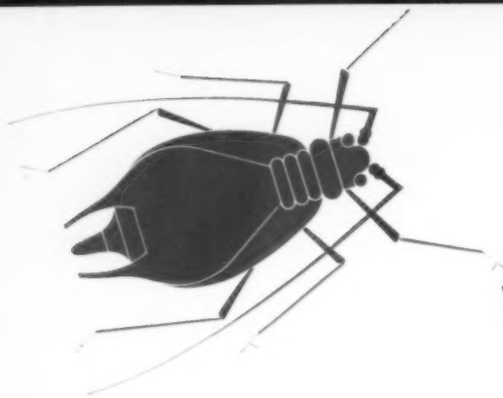

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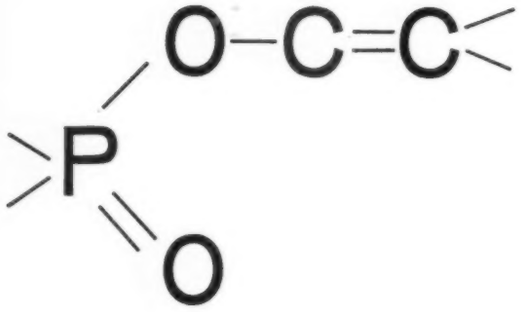

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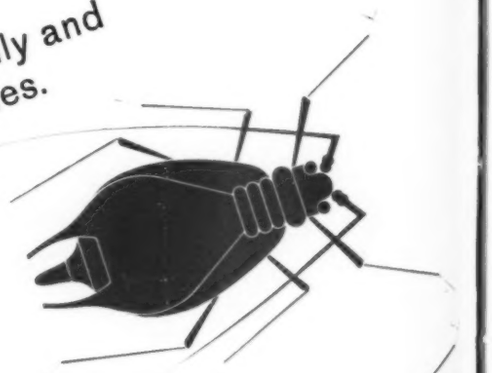

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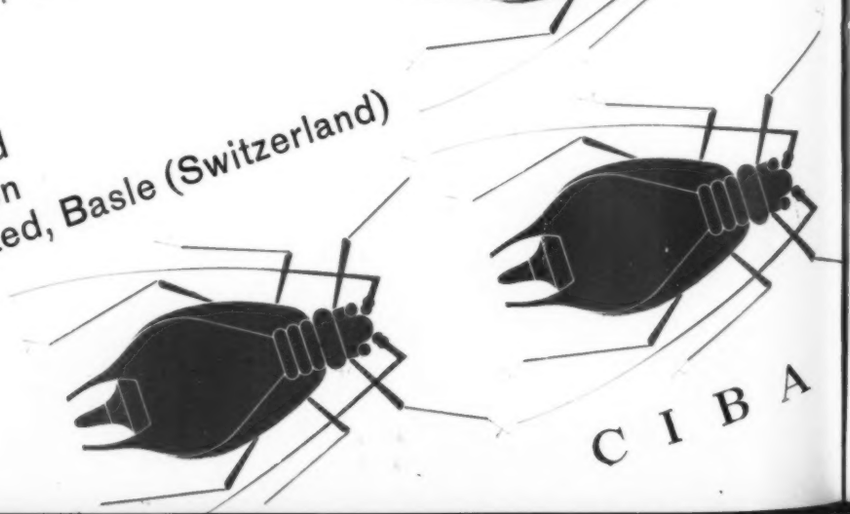

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WORLD CROPS

The International Journal of Agriculture

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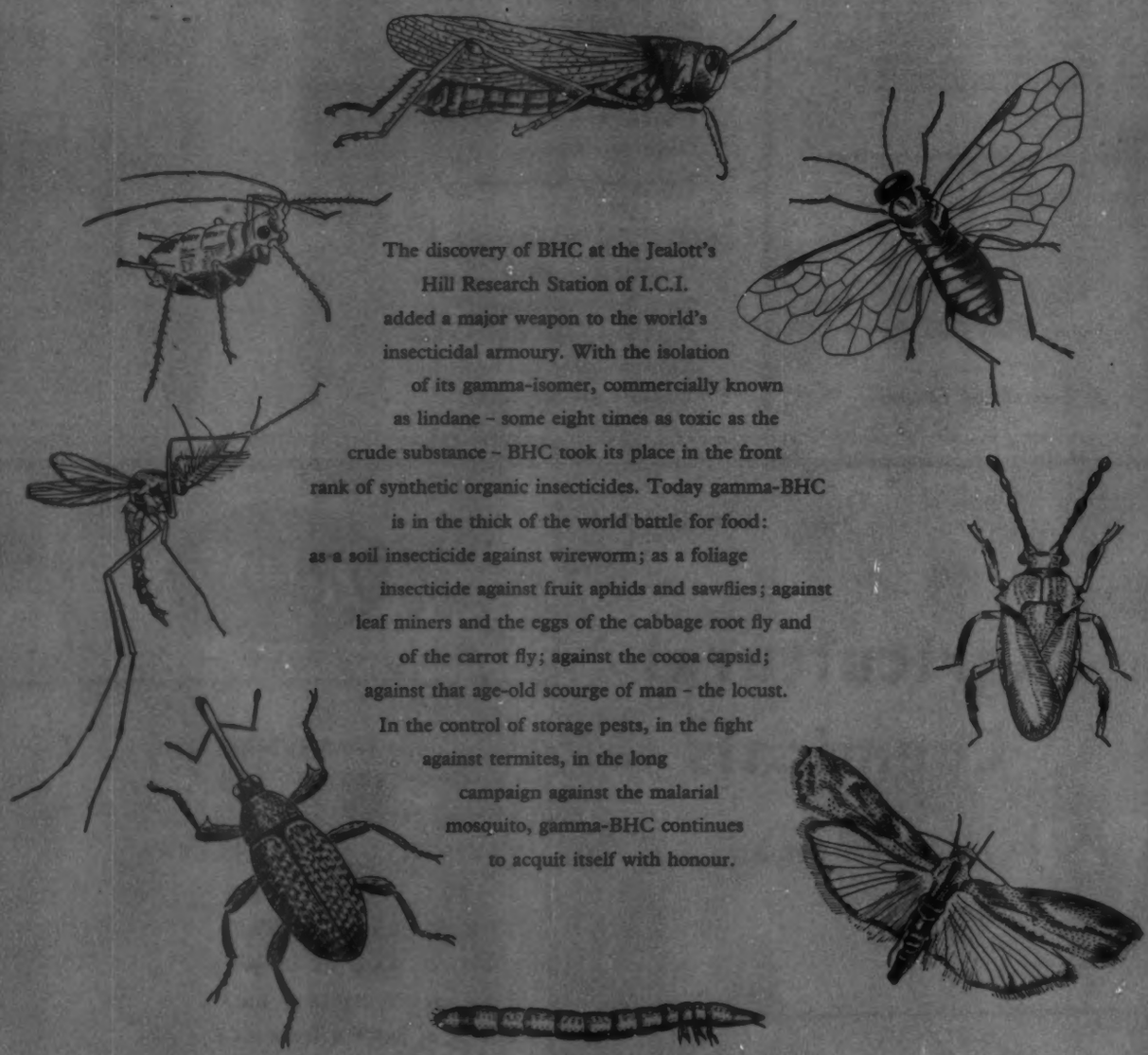
BETTER HARVESTS ROUND THE WORLD

BHC: England: 1943



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Editorial Comment

Why Plough?

THIS WAS THE THEME of an open forum at the annual conference of the Institution of Agricultural Engineers. The argument was started by Mr. James Gass, of Ransomes, Sims & Jefferies Ltd., who gave us his reasons why we should plough. He said that ploughing was the quickest and cheapest method of preparing land for a crop. It buried weeds, allowed the exposed soil to weather and turned in crop residues. The plough, he rightly submitted, had reigned supreme for 2,000 years and he considered it would continue as the farmer's principal cultivation implement.

Shallow Cultivation Preferred

The challenge was met by a Hertfordshire farmer, Mr. Paul Harding, who took the opposite view. He said he had been brought up to accept the plough as a tradition of farming and did so without question until some years ago.

He now considered that when weeds and crop residues are buried deeply by a plough they take a long time to rot down, whereas the heavy single-gang disk harrow effectively buried the surface vegetation in the top 6 in. Here the residues rotted down quicker and produced the required tilth in three passes much more cheaply than with the plough.

Subsoiling and Shallow Cultivation

Mr. Hawkins, of the National Institute of Agricultural Engineering, the last contestant, came down in favour of shallow ploughing, and he added that deep ploughing was largely due to the influence of the high-powered tractor, as plough body design did not match the greater power. Possibly with selective chemical weeding in favour of the crop the tined cultivator would ultimately take over from the plough.

We consider that whether you cultivate deeply or only the top 6 in. the essential requirement is that the organic matter must remain in the top soil to give the young plant the conditions it needs. In tropical conditions, where a hard pan is liable to develop, the need for deep ploughing can be met by subsoiling, which does not move the surface vegetation at all.

Subsoil Cultivation

The main value of an occasional deep ploughing or subsoiling is to break up the hard pan which may develop in the soil through the movement of farm implements over a number of years, or in the tropics as a result of the passage of heavy rains washing out the silt from the upper layers and collecting as an accumulation which consolidates at a lower level.

Hard pan, by preventing the proper percolation of water through and down into the soil, can produce waterlogged conditions in the rains and excessively dry conditions during periods of drought and by hampering root development can have an adverse effect on plant development and crop yields. This is one of the causes of the infertile and parched badlands in the tropics.

Bulk Handling of Grain

IT IS DISAPPOINTING to learn that so little progress has been made in Britain in the past two years in the bulk handling of grain from the farm to the mill (see WORLD CROPS, 1959, 11, 88), whereas in the main grain-growing countries of the world it is now a universal practice.

A recent survey carried out by the National Association of Corn and Agricultural Merchants showed that in Britain little bulk movement of oats is reported and wheat is the main crop moved in bulk. There seems to be some resistance from the maltster, with some exceptions in East Anglia, to receiving barley in bulk.

The East Anglian merchants are collecting about 15% of their wheat in bulk; in other wheat areas only about 5% of the wheat is moved in bulk. Nevertheless, there are individual merchants who are handling over 50% of their total wheat purchases in bulk.

Thus, despite the publicity given to modern methods of grain handling, the modernisation of storage and handling equipment on farms is hanging fire. Those who have blazed the trail have found it an economical proposition, so why not others?

Resistance to Change

Change and decay in all around I see.

HENRY FRANCIS LYTE (1793-1847)

WE ALL OF US have a resistance to change—even the 'beatniks' have their prejudices. Perhaps the hardest task of us who serve agriculture is to overcome this resistance to the amazing changes that are taking place in this field of work, especially in the more backward countries, where with the arrival of self-government, the extension officer has suddenly become the weakest link in the chain of progress. On him now depends the implementation of the results of research and the plans prepared by the regional committees of FAO for improvement in the economic conditions of underdeveloped countries.

If an overall increase in crop yields is to be obtained, not just a limited success here and there, inspiration, leadership and drive will be necessary to provide adequately for our children's children. There are barren lands to be reclaimed; swamplands to be won from the sea; approach roads to be built and properly

maintained; new areas to be opened up and colonised; water resources to be harnessed and efficiently distributed and used; and the already existing agricultural lands to be made vastly more productive by the use of certified seed, correct use of water, and the sound application of modern methods of pest control to suit local conditions.

Competitive Nonsense

Anything you can do I can do better,
I can do anything better than you.

'ANNIE GET YOUR GUN.'

WE FOLLOWED THE amazing journey into space with a tremendous thrill and we congratulate not only Alan Shepard, the astronaut, but all concerned in the successful outcome of a magnificent experiment, which, in our opinion, is second only to the first splitting of the atom in the Nevada Flats in 1945.

The flight to the very edge of space was a perfect team operation and the three postponements implied a persistent refusal to be stampeded either by political considerations or public clamour, which was in the best traditions of science. The result was perfect timing and total success. Even so, it falls far short of the Russian accomplishment in putting a man into orbit around the earth, but while one was fully authenticated, the other will remain merely an unsupported claim.

However, we must view both achievements in the correct perspective, for after all 115 miles is only a puny invasion of the infinite immensity of space. Now the Space Administration officials of America have declared that this flight is only a beginning. 'In time we expect to go to the moon and back' (a mere 444,000 miles into space), and to go one better the Russians, according to Major Gagarin, are already planning a flight to Venus (25.7 million miles—one way only). When is all this competitive nonsense to end?

Feet on the Ground

Let us examine the factor of cost. The first fire balloon to reach a height of one mile cost, say, £1,000 (in present values); the first aeroplane to reach 20 miles, together with the associated research, probably cost something of the order of £500,000. The latest effort, manned flight to a height of about 115 miles, is stated to have cost £117 million. At this point space in the astronomical sense begins and the cost becomes progressively astronomical—*far more than £1 million per mile.*

Meanwhile, we all need to keep our feet firmly on the ground. Scientific research in the field of agriculture and the vast schemes for the improvement and extension of the agricultural resources of our earth must not be handicapped because of excessive taxation and over-concentration on this costly new field of research. Food is, and must remain, the first call on world resources—and we are not doing too well in this field of human activity.

Money Better Spent

BRITAIN'S RESPONSIBILITIES have not ended with the assumption of self-government by former colonial territories. On the contrary, the need for technical education and technical assistance is growing.

It has been announced in a recent White Paper* that an Overseas Technical Service is to be set up at a cost of £150 million per annum to the British taxpayer and we consider that this is money being far better spent than on wild adventures into space. The goodwill that technical assistance can promote will be invaluable, but even more important is the creation of employment opportunities in a world becoming increasingly more crowded.

Apprenticeship Training

One other big effort by Britain was Commonwealth Technical Training Week designed to underline the importance of apprenticeship training in developing skilled manpower in these overseas territories, so that modern methods and modern machines can be understood and used to the best advantage.

It might be considered invidious to single out an individual programme for special mention, as in any enterprise of this sort the humble effort of the small community may well be equal in merit to the more ambitious performance of a city, such as Coventry. However, we think it would not be out of place to give just one example.

Apprentices on Parade

As part of the activities in Coventry, Massey-Ferguson Ltd. arranged a visit to its training school for representatives of the Commonwealth High Commissions in London, the Commonwealth Relations Office and members of the corps of Commonwealth journalists to see what they are doing to produce skilled agricultural personnel.

The school at Stoneleigh Abbey is, we consider, one of the most remarkable agricultural machinery manufacturers' training schools within the Commonwealth. A regular series of comprehensive courses lasting for about 12 weeks is held to meet the special needs of overseas students. These cover both workshop and field operations with a wide range of agricultural machinery and implements.

At the time of our visit there were some 50 students from Malaya, British Guiana, Ceylon, Ghana, India, Pakistan, S. Rhodesia, Mexico and Europe. It appeared that a well-judged balance was being maintained

*Technical Assistance from the United Kingdom for Overseas Development, Misc. No. 1 of 1961. H. M. Stationery Office, London. Price 2s.

between theoretical instruction in the well-equipped lecture rooms and practice in the workshops and in the 300 acres of parkland which surround the school. Use was being made of visual aids to teaching, such as films, working models and sectioned components, and laborious paper work for people to whom English was a second language was reduced by the provision of complete sets of notes on the lectures given.

Monster Problem

THE LARGEST MAN-MADE lake in the world is now presenting the largest weed problem ever found on any lake. The moment the lake began to form the aquatic weed, *Salvinia auriculata*, made its appearance and has flourished so well that it is reported that already one-seventh of the lake's 1,160 sq. miles is now covered with a thick mat (see p. 112 of March issue).

In Ceylon, where this weed is also a major pest, the floating mat may be about a foot thick and all efforts to destroy it have been in vain, as reintroductions occurred through the weed being carried from lagoon to lagoon and from paddy field to paddy field on the feet of aquatic birds.

Obviously what is immediately needed is some weed-killer which will keep the weed in check. Getting rid of the weed completely is likely to be an expensive business, particularly as there is the constant risk of re-introductions as occurred in Ceylon.

One possibility is that the weed could be used as a mulch for the improvement of poor soils, though it is of little value as a base for compost, as there is so little solid matter in the material. This vegetation floats because it is full of air and the work of bringing vast quantities of wet weed ashore for conversion into compost would cost more than the value of the resulting manure.

Dates in U.S.S.R.

THE DATE PALM, *Phoenix dactylifera*, has failed in the Caucasus, but has been grown successfully since 1956 in Turkmenistan, bordering on Persia. This remarkable development, we learn, is the outcome of much research on breeding and selection, following Michurinist principles, suited to the climate of the southern part of Soviet Central Asia.

Seeds and 200 cuttings of various varieties were started there in 1936 and by 1939 some flowering and fruiting was observed. The best and hardiest specimens were selected for further trials and breeding. Work was interrupted by the war, but has been intensified since.

Optimum propagation and cultivation techniques have been worked out and fertilising (with organic and mineral fertilisers), irrigation and sterilisation of the fruits for transport are also under study. Early-ripening varieties have been found to be the most promising, but varieties from Northern Algeria and Tunisia, Egypt and the mountain areas of Persia are also considered to be worth attention.

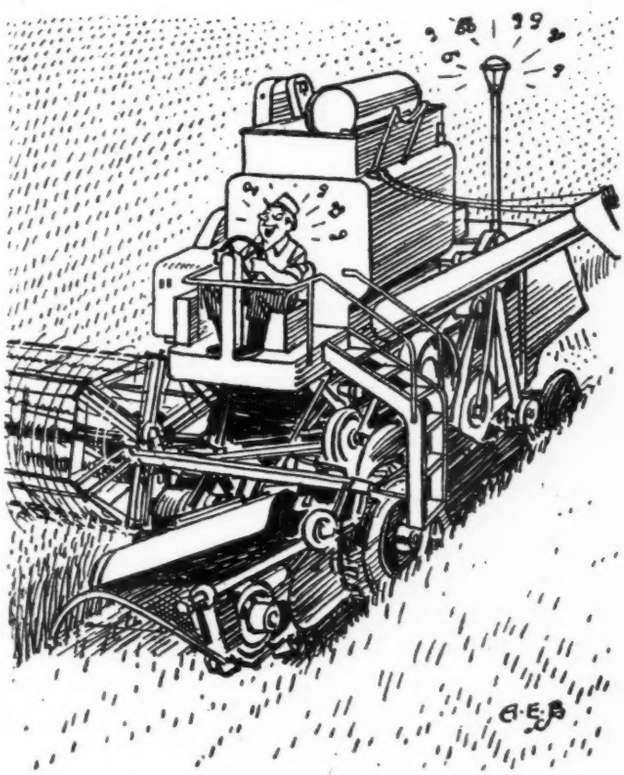
The date palm grows best in temperatures of 90°-120°F, but it can also withstand quite severe short frosts; for instance, in the Kizyl-Atrek region it has been defoliated from exposure to 25 degrees of frost, but has recovered. Palms 14 or 15 years old attain heights of 6 or 7 m., the stem being about a yard in circumference and the crown consisting of some 25-35 leaves.

Music Hath Charms

THE AGE of miracles is not past. This was brought home to us recently when we read a news item seriously reported in a responsible British newspaper. Their correspondent in New Delhi had reported that India may soon broadcast music to growing crops, for experiments had apparently revealed that a rice paddy field 'excited' by music had produced from 22-58% more rice. The probable error is not recorded!

The technique involved broadcasting soft music to standing crops from strategically placed loudspeakers. 'The Indian Government was checking the effectiveness of this technique', according to a statement attributed to the Minister of Agriculture, 'and if results were successful it might consider the large-scale use of music to increase food output'.

No doubt the hypothesis will soon be propounded that in the same way as photosynthesis is responsible



'To plough and sow and reap and mow
And to be a farmer's boy . . .'

for conversion of sunlight into energy, so 'aurosynthesis' can convert sound waves into plant food. A little daring, perhaps, but in this day and age we need to be bold in our speculations.

Food Wastage

THE ASTONISHING FACT that if wastage of the world's food were eliminated the world's starving millions could be fed was strikingly emphasised recently by Dr. A. L. Stahl, of Miami University, who has spent a year in India as an FAO technologist. He made the startling statement that one-third to one-half of all vegetables and fruit harvested in India are now lost through poor handling and marketing, and that much of the present grain stock is lost to insects, vermin and decay as a result of poor storage and transportation.

One of the obstacles to change is conservatism in eating habits, and the average Indian's insistence on demanding all his fruit and vegetables fresh from the market every day means that everything is rushed to the market, but only a half to a third of it is actually sold. With proper processing the surplus could be saved.

It is evident from reading the FAO report that what is needed in India, and presumably in other under-developed countries, is a reorganisation of food processing and handling methods so that wastage is eliminated and more effective use made of available labour. To achieve this, much more mechanisation *in the right places* is needed.

Mechanisation in the wrong place could make things worse, and Dr. Stahl cited a processing plant for oranges whose very modern juice extracting and concentration equipment was working at only a fifth of its capacity because the fruit was weighed, washed and carried up three storeys to the extractor by hand.

In 10 years India could have a major food processing industry; she already has the food technologists and the businessmen. Better varieties of fruit and vegetables would double the farmer's output, and with a sound food processing industry, India could become a food supplier for the rest of Asia.

This Month's Cover Picture

Boron deficiency seriously affects the growth of leguminous forage crops, especially lucerne. The common symptom is yellowing or reddening of the upper leaves, accompanied by stunting of the upper portion of the stem, which may give it an umbrella-like appearance.

Effects may only be noticeable in isolated plants (see cover illustration) or may cover large areas. The results of boron deficiency are reduced herbage yield and increased persistence in the face of adverse conditions or weed competition.

An adequate supply of available boron is particularly important where lucerne and clovers are grown for seed, since deficiency reduces the number of flowers and affects pollination and seed formation.

Certain soils are naturally boron deficient, including those derived from sands or of organic origin. It may also be induced by overliming, its effects becoming particularly noticeable in dry weather. An application of borax or a boronated fertiliser to the soil, or the use of 'Solubor' as a spray, restores the boron balance, promotes healthy growth and can result in remarkable improvements in yield and seed production.

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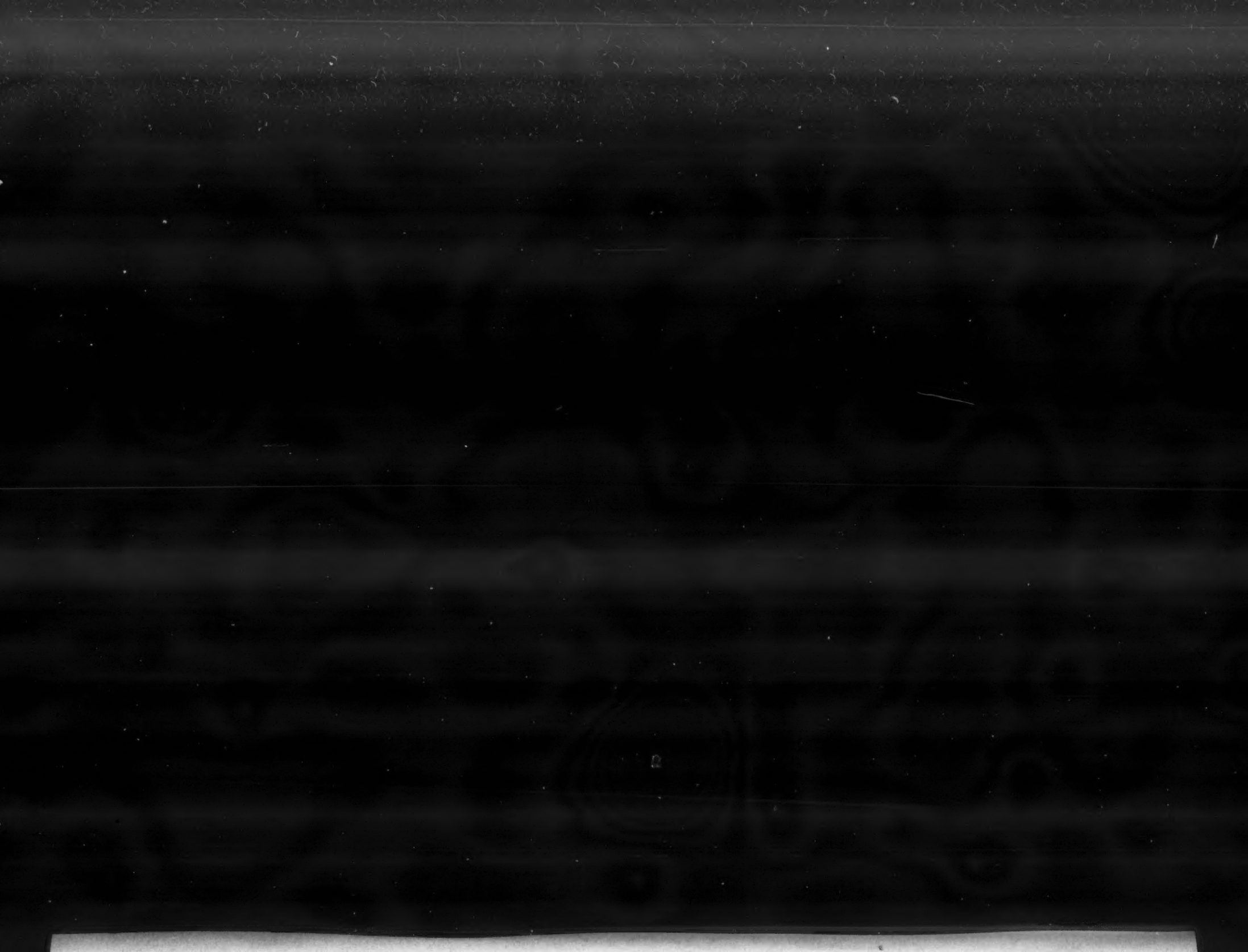
One idea is to have a floating Smithfield Show—to charter or buy outright one of the vessels which are at present lying at anchor in the backwaters and estuaries around the coast of Britain and fit it up as a floating exhibition of agricultural machinery and chemicals, with special field demonstrations ashore at the various ports of call on a round-the-world cruise?

Men are also available in considerable numbers who understand the customs, language and 'way of life' of the people of overseas territories—from Uganda alone, 300 Britons are being retired. Their previous experience in selling ideas can be used to good effect in selling and demonstrating our products.

The whole world needs tractors to assist and increase productivity, to reclaim derelict lands and bring them into effective production. The ways and means to achieve increasing world prosperity and to beat the threatening world depression are available if we have courage and high optimism. The under-developed countries urgently need our products and, of course, we need theirs. Have we the will to succeed?



Left: *Sunn hemp*, Crotalaria juncea, *sown as a green manure crop in Rhodesia.* Right: Crotalaria quinquefolia, *a promising new green manure crop*

GREEN MANURING IN THE TROPICS

A Challenge to Tropical Research!

G. B. MASEFIELD*

Green manuring in the tropics, once a favourite subject for experiment, has attracted less scientific attention in recent years. As a farming practice it is probably declining in more countries than those in which it is increasing. This is no doubt largely due to the great advances which have been made in other methods of maintaining soil productivity.

THE statistical ingenuity and experimental assiduity which have been devoted to fertiliser experiments throw into relief the inadequacy of many of the older experiments on green manuring. A renewed and better-planned experimental approach, taking advantage of new knowledge, to the problems of green manuring might help to reduce this lack of balance.

Since it is so largely leguminous crops which are used for green manuring in the tropics, the discussion can be concentrated on these. In a large number of the older experimental reports we are simply told that a green manure crop was grown and are then given a great deal of detail about the behaviour of the crop that followed it.

Without such important information as the plant population of the green manure crop (whose significance will be discussed later), an estimate of its yield, an assessment of the degree of root nodulation and other data, it is impossible to evaluate the reasons why green manuring in one experiment is less successful than in another. It is hardly surprising that with this standard of experimentation, the subject has not advanced very much.

Mobilisation of nutrients

With the high popularity of legumes as green manures, it is the contribution they may make to the rotation by fixation of nitrogen which is often first considered. It has been calculated in Southern Rhodesia that even today the cost of supplying nitrogen to the soil may be fractionally cheaper by green manuring than out of the fertiliser bag.

But nitrogen is not the only nutrient which green manures may supply; it has been claimed that they also benefit following crops by mobilising phosphorus, potassium and copper in the soil. The value of any contribution they may make in organic matter is more questionable, because it is so transitory in many tropical soils and is offset by the loss of soil structure due to the extra cultivations which green manuring necessitates.

It is true that cost comparisons between green manures and fertilisers do not take into account the use of additional land which green manuring may involve. But there are still wide

* Department of Agriculture, University of Oxford.

areas of the tropics where land is not a limiting factor. And it can also be argued that, while fertiliser nitrogen is paid for in cash, the cost of green manure nitrogen is almost entirely in labour. There are many tropical peasant societies in which labour is abundant, but money so scarce that the option for fertiliser nutrients is hardly open to the people.

Green manuring for certain crops

Technical considerations, not always valid, have also sometimes induced the adoption of green manuring. Thus, with tobacco it has been feared that a dressing of fertiliser nitrogen might spoil the quality of the leaf and it has been held that the slower release of nitrogen from a green manure would avoid this. Similarly with cotton, nitrogen fertilisers have sometimes been avoided as likely to promote vegetative growth and increase susceptibility to diseases and pests rather than improve the yield of lint.

However, the main case for renewed experimental attention to green manuring rests upon the potential improvements on present methods which might be made as a result of further research. Some of the factors which require scientific attention can readily be suggested under a number of heads.

Use of mixed green manures

Considering the common practice of mixed cropping in the tropics, and the current trend towards using a mixture of legumes when cover crops are sown, it is surprising that the effect of mixtures for green manuring has scarcely been studied. A. J. Pieters, in his book 'Green Manuring' (which, although published as long ago as 1927, is still the 'standard work' on the subject), could apparently find no experimental evidence on this aspect. He was only able to make a rather vague statement, which does, however, indicate its importance:

'In Germany a mixture of various legumes is said to give better results than any one alone. Both Schultz (whose long personal experience lends special force to his opinion) and Wagner advise mixtures of peas and vetch, or peas, vetches and horse beans as more certain to give good results than any one of these alone'.

It is evident that this is another subject which ought to be thoroughly probed by research.

Photo: East African High Commission

The large size and abundant number of nodules on a small part of the root system of Psophocarpus tetragonolobus

New green manure crops

The few green manure crops in use are not necessarily the best ones, and there are thousands of tropical legumes which have not been tested in this respect. As long ago as 1914 crops of sugar-cane in Burma were, again vaguely, said to be increased by 50% if they followed the legume *Psophocarpus tetragonolobus* in the rotation. This legume is now known to be capable of quite exceptionally heavy nodulation, yet it still remains to be investigated as a green manure.

Another species which has also been suggested as having potentialities on account of its abundant nodulation is *Mimosa invisa*. *Sesbania speciosa* is a newcomer among green manures which is already giving promising results in India. Another is *Crotalaria quinquefolia*, which is reported from Surinam[1] to have increased the yield of following rice crops by more than 1,000 kg. per ha. These examples are sufficient to show the wealth of untapped material in the tropics that awaits experimentation and trial.

Close spacing of green manures

The few observations that have been made indicate that, as leguminous plants are spaced more closely, they decrease in size, but may still carry the same weight of nodules per plant; thus the weight of nodules per acre is increased by close spacing. In so far as a main object of green manuring is the fixation of nitrogen and its incorporation in the soil, a high density must, therefore, presumably be beneficial.

This may partly provide the justification for the empirical practice of farmers, who normally sow legumes at a higher seed rate for green manuring than for grain, though recent research also suggests that on other grounds optimum densities for dry matter production are not the same as for grain. In many cases, however, it may be doubted whether the seed rates currently used are high enough. How far plant population can actually be increased before total yield of green matter, nodules or nitrogen begins to decline is another important aspect to be determined by experiment.

Fertilisers for green manures

This is a subject which has hardly been broached experimentally, no doubt because the use of fertilisers on green manures was thought to be uneconomic. But in Malaya it is considered profitable to apply superphosphate to leguminous cover crops with the idea of promoting nitrogen fixation from which the associated rubber crop will benefit. With crop-grass rotations in Uganda it has been found about as profitable to apply superphosphate to the grass phase of the rotation as to the subsequent crop phase. The subject is worthy of more investigation.

Disease and pest control

Too little attention has been paid to the diseases and pests of green manures. In the early days of green manure experiments in Nigeria it was reported that *Dolichos* had a better effect on following crops than did *Mucuna*. Yet *Dolichos* was dropped from the programme because of its greater susceptibility to disease; *Mucuna* became the standard green manure of the country, but has never been widely accepted. More recently sunn hemp, *Crotalaria juncea*, has been losing favour as a green manure in Rhodesia because of the incidence of 'stem-break' disease. In this case the organisation of disease-free seed supplies, which could be done quite cheaply, would be a long step towards control.

Increase of root nodulation

The development and distribution of effective strains of the bacterial symbiont for inoculation has only just begun at one or two places in the tropics, and has scarcely been applied yet to green manure crops. It is true that most short-term tropical legumes belong to the so-called 'cowpea cross-inoculation group' and will form some nodules on most tropical soils.

This characteristic has no doubt delayed the search for really effective strains, which could be one of the cheapest methods of increasing productivity in any major group of tropical crops. Increases in the yield of soya beans in the former Belgian Congo by up to 300% by this means, and the scale on which commercial inoculation of legumes is already being practised in Australia, indicate the potential possibilities.

Nodulation can also be increased by environmental changes. It is known, for example, that both irrigation and mulching will promote it, and there may be some cases where these treatments would be economic on green manure crops.

Further long-term possibilities arise from the known fact that tetraploid cells are associated with nodule initiation in the legume root. The nodulation of legumes in artificial culture has been increased by the presence of colchicine in the substrate. Artificial tetraploid plants are often agriculturally valueless because of their low fertility, but a tetraploid strain of berseem, *Trifolium alexandrinum*, has been produced in India,[2] which is fertile and is stated to be superior to normal strains in both nodule development and yield. From Egypt[3] it is claimed that seeds of the same crop treated with colchicine produced plants on which the nodules were formed earlier and were tripled in number.

Summing up

Enough has perhaps now been said to justify the suggestion that, if even a fraction of the research that has been given to fertilisers in the tropics were to be devoted to green manuring, the practice might be found to be more competitive than it appears today.

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Flyweights

The problem of deciding whether an insect is simply paralysed by an insecticide or is killed by it has been engaging the attention of Dr. D. Spiller, senior entomologist at the plant disease division at Mt. Albert, New Zealand.

As much of Dr. Spiller's work is concerned with insecticides and the way in which they work, it is most important for him to know whether a poison actually kills the insect and, if so, how quickly. According to the *New Zealand Herald*, he has built a sensitive piece of equipment which he hopes will solve the problem—by weighing each insect.

Dr. Spiller discovered, when working at Cambridge a few years ago, that a living insect, whether paralysed or not, loses water at a certain rate when placed in a completely dry atmosphere, but that a dead insect is dehydrated much more rapidly. Thus it should be possible to tell whether an insect is dead by measuring the rate at which its body loses water in a dry atmosphere.

Ordinary houseflies, for example, weigh about 18 mg., or about 1,400 to the ounce. The amount of water lost in an hour is generally less than 2 mg., or less than the weight of one human hair.

The special balance which Dr. Spiller has built, using designs developed by chemists and physicists, will continuously record the weight of the insect by electronic means. In this way a fly can be weighed in a tiny stainless steel cage carefully hung from the beam of the recording balance, and as the weight changes, electrical impulses are given out, which are amplified and then recorded on a moving paper chart.

FLAX

Its Story and Its Future

A. E. HAARER, F.L.S.

This article discusses the history of flax production, and then points to the fact that the growing of flax in Britain, revived during the war, has now practically ceased. The author makes a case for encouraging flax growing in Kenya, utilising the equipment provided in this country under the war-time scheme.

Photo: Australian News and Inf. Bureau

Retted flax straw, having dried in the sun, being tied into bundles for stacking

FLAX is two things—a plant with a tall growth, branched only at the top of a slender straw-like stalk and bred for its line-fibre; and a shorter, branched plant, bred to produce more flowers and hence more seed, which is called *linseed*. Both plants are known botanically as ***Linum usitatissimum.***

Competing fibres

Once the most important textile fibre, flax was largely replaced by cotton, now giving way in turn to man-made fibres such as nylon for some of the finer fabrics. Flax, however, is still one of the most excellent fibres for cloth which must have absorbent properties, such as tea cloths and towelling.

The only other fibre with such excellent absorbent properties is ramie, which is in short supply and is unlikely to compete seriously with flax because of its finer quality, its use for special purposes and hence its higher price. Nylon, too, can only compete with flax for high-quality goods. The coarser flax fibres are made into sailcloth, canvas, strong threads and some cordage, fields in which it cannot be beaten except by fibres of almost equal quality but of lower price.

Freshly scutched hanks of flax fibre, stored as they should be in a dimly-lit and cool place, have a sheen and a cool silky feel.

History

Flax or true hemp was the only line fibre used in ancient times. The fibre was first straightened and smoothed, and then twisted between the fingers into yarn before spinning wheels were invented and introduced to Europe. There are authentic records of the cultivation of flax in Egypt as early as 2000 B.C., and linen more than 3,000 years old has been recovered from the tombs of the Pharaohs.

The vegetable-fibre industries grew rapidly in Europe throughout the Middle Ages and there were no startling changes in the methods used for cultivation, extraction, spinning or weaving until early in the 18th century. Despite the primitive methods used, a variety of products were made, ranging from coarse clothing to fabrics of fine texture; threads, laces, canvas bags, sacks, sails, twines and ropes.

This led to the cultivation of larger acreages in place of many scattered plots; to the installation of the factory system to replace home spinning and weaving. Furthermore, improvements in education led to higher standards of living, and larger populations required greater supplies of the raw product, including cotton, which had already begun to compete with flax.

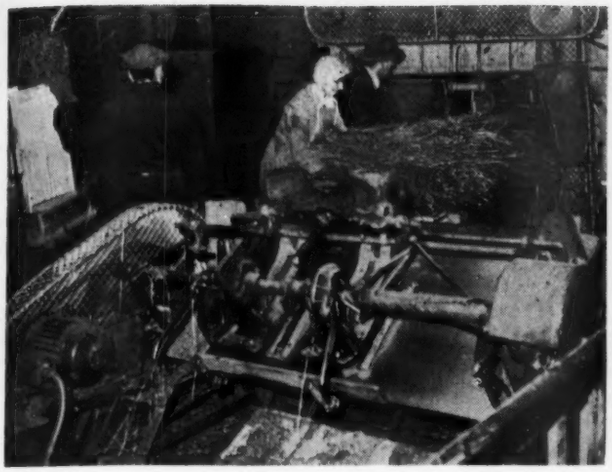
It is curious that cotton and jute, both grown in tropical lands and both transported from a distance, should have succeeded so easily in robbing the flax industry of its importance. Among the chief reasons were, and still are, that cotton and jute are mainly produced by cheaper labour in regions where land is nothing like so valuable.

Cultivation

Flax grows best in regions where temperatures are cool but the sun is kind, and not fierce as in the tropics. The soil must be moist, friable, fertile and well drained. Flax is bred to give a straw length of 28-30 in., and both soil and climate should enable this length to be maintained. Moreover, a field should have an even growth. Unfortunately, European seasons vary and variations during germination and growth periods affect the quality and yield. Drought, perhaps, is most to be feared because it stunts the straw.

Ground for cultivation has to be fairly level and of even fertility to ensure an even length of straw. It is ploughed in autumn and harrowed and rolled in the following spring to provide a good seedbed. If the soil is light, then surface tillage to destroy weeds is all that is necessary.

Although flax likes a soil enriched with organic manures, it was found best to manure a previous crop in a rotation so that the flax benefited from the manurial residues.



Left: *Loose armfuls of flax emerging from the deseeder to be re-bound in the machine in the foreground, whence the sheaves will drop on to a conveyor. On the left of the picture the loose stalk is being 'danced' on a jogging table to bring the butts into aligment.*
Right: *This is what the flax looks like after it comes out of the scutching machine which has 'scutched' off the hard and dry sheath of the stalk, leaving the soft fibres behind*

Flax in Britain was grown in rotation with grass, wheat, potatoes and legumes. The crop often grew healthier if it was given a little sulphate of potash on soils deficient of this element.

Seed sowing is done when there is no longer fear of frost, the seed often mixed with dry earth when broadcast to give an even distribution. Afterwards the ground was lightly harrowed and rolled.

Weed control

In England flax appears to hold its own with weeds, for in areas of the Fen country its blue flowers may be seen everywhere among corn just as red poppies used to grow. Yet it must suffer from competition and it would be wiser to sow flax on clean, well-tilled land. Flax grown for linseed is tolerant to herbicides that kill both grass and broad-leaved weeds. Yet, when MCPA is used against broad-leaved weeds and TCA against grass, some damage is done to the flax plants which might seriously stunt a crop grown for line fibre. Such chemical weedkillers should therefore be used with the greatest of care.

Harvesting

The harvesting of flax is done when the lower portions of the stems turn yellow, when the leaves begin to fall and the topmost seed capsules have turned brown. The straw must then be pulled, not cut, and the sheaves stood in shocks to dry before stacking in the normal way applicable to wheat. In bad weather it might be necessary to spread flax to dry and machines are available for this purpose.

Foxton Flax Mills. First stage of manufacture. Hanks of 'scutched' fibre being fed into a machine to be combed out into a continuous string

Storage and retting

The safe storage of flax is best accomplished in the dry-straw stage before retting, though the material is bulky, otherwise the extraction processes should be completed and the fibre itself stored in a dimly lit, cool, humid storehouse, where the temperatures are even and controlled. Straw may be stored in a barn or in a properly constructed and thatched stack, like a haystack.

There must be some consideration given, however, to the method of retting and seasonal facilities. Flax is both dew and water-retted. If it is dew-retted, then this must be done at the proper season of the year, as it must be if it is water-retted under natural conditions in ponds, lakes or rivers. If it is water-retted with the *p*H values and the temperatures strictly controlled in special tanks, then the straw may be stacked and stored beforehand for many more months without harm.

Flax processing

For economic reasons the flax retting centres in Britain were built

just large enough to cope, so that the straw could be stored and fed to the retting tanks as required to keep the machinery and skilled hands working all the year round.

The dried straw was brought in over a weighbridge to the intake elevators in which the sheaves were carried to a top floor. Here they were opened and the straw placed on a moving table to be carried sideways into a de-seeding machine. This machine combed the capsules to one side and weeds to the other, while the straw was held gripped in the middle.

Clean straw, collected in armfuls and placed, butts downwards, on a vibrating board to bring the stems into alignment, was then bound into sheaves again and dropped on to a moving conveyor for transport to the retting tanks or for stacking as required. The seed capsules were crushed, the seed winnowed to separate the chaff, sieved to eliminate weed seeds, and then treated with preservatives to safeguard it from mildew. The weed combings and short straws were sold for packing purposes.

A centre in Sussex

Retting tanks about the size of a moderate-sized room were arranged at the Sussex centre to empty by gravity into storage reservoirs so that the water could be pumped back and used again with a little extra water each time. They were built of concrete and had large water-tight doors in the sides so that the straw could be run inside and stacked vertically in layers. The tanks were topped with gratings to hold down the straw as it began to float.

Water entered from pipes below the flooring. The acidity and temperatures of the water were checked and the water aerated. The retting process took about three days, after which the straw was taken out and drained, then placed on a moving belt to take it through the drier, where hot air passed to and fro through the straw. It was found that the straw must be stacked afterwards for a period of not less than six weeks to mature.

The scutching machines delivered clean line fibre, separating it from short fibres and 'shives', *i.e.* the pith and woody portions of the stems. The tow was recovered afterwards and the shives used for fuel.

Government aid

During World War II, America, Canada and Britain began to encourage flax growing on a larger scale, and until the early 1950s it was a common sight in England to see fields of bright blue flowers dotted about the countryside, especially in the neighbourhood of the retting establishments. Indeed, there could never have been more help freely given to farmers to cultivate a crop than was given to the flax growers.

Despite this, the industry revived for a few years only. The Ministry of Supply and the Board of Trade co-operated to erect regional retting and scutching mills, and in 1950 there were 10 operating in the U.K., seven as agencies, and those of Norfolk, Yorkshire and Sussex directly controlled by the Board of Trade. All have apparently been closed down, except for a small part of the Norfolk centre, engaged in breeding and research.

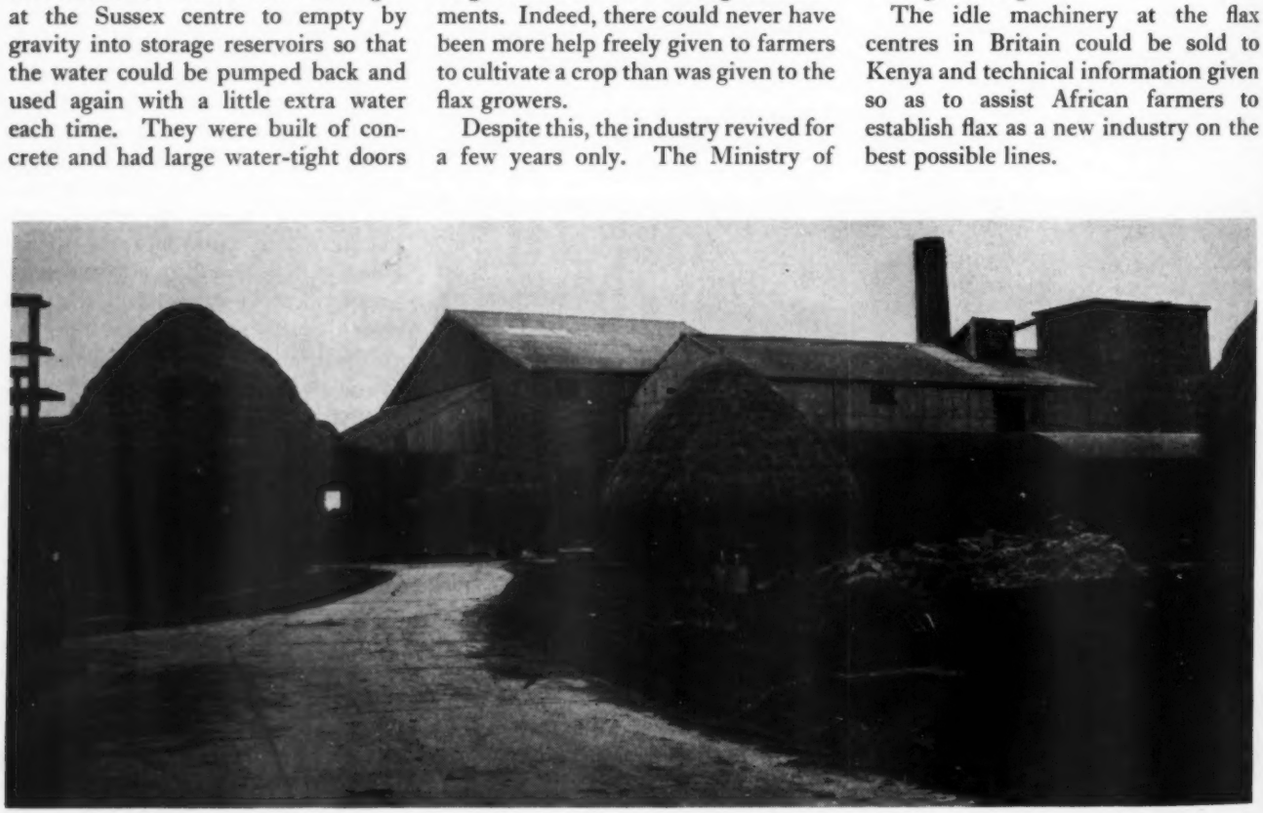
The organisation had been complete, the centres supplying clean, approved seed for the various counties and giving such advice as was required by the growers. The Sussex establishment, for instance, dealt with flax from over 1,600 acres which farmers contracted to grow. All the farmers had to do was to sow and grow the crop, and stack the straw until the retting establishment was ready to take delivery. They were supplied with machines for pulling the crop.

It is regrettable that, except for Ireland, there is no flax fibre now produced in the British Isles.

Possibilities in Kenya

Flax could be grown in such places as Kenya at the higher altitudes if only advisory services of the same kind were given to growers.

The idle machinery at the flax centres in Britain could be sold to Kenya and technical information given so as to assist African farmers to establish flax as a new industry on the best possible lines.



The Flax Retting Establishment in Sussex. A trailer is seen between two Scottish-style stacks of flax straw waiting to be retted

Left: *A 32-h.p. 'Dexta' ploughing a 16-in. furrow. The work continued day and night.* Right: *Night—and the shadows falling. The tractor ploughs steadily on*

Ploughing Round the Clock

100 Acres in 100 Tractor Hours

F. C. COOKE

Owing to the vicissitudes of climate, it is not always possible for national targets of agricultural production to be realised. Work may fall behind schedule either because of too much rain in temperate regions or because of too little in the arid tropics. In such cases it is possible to make one tractor do the work of three by 'working round the clock' when conditions are favourable.

RECENTLY a timed performance trial was carried out on two farms at Kinross, near Perth, in Scotland, with two 32-h.p. 'Dexta' tractors working continuously 24 hours a day until some 200 acres of ploughing was done. The purpose was to see how much work could be completed in 100 hours, including all stoppages. Only one of the tractors was new; the other was nearly two years old and had done many hours of work under normal farm conditions. The new tractor was taken at random from the hundreds that leave the production line and was not specially prepared for the occasion.

Conditions of operation

The 16 fields covered during the trial were of all sizes and shapes; eight of them were under 10 acres, and only two were over 20 acres in extent. Only two of the fields were approximately rectangular; all the others had short ends and odd corners to slow up the work. The two farms provided a variety of conditions—including grassland, dunged and undunged stubbles and hard redland; some had to be ploughed 10-11 in. deep for root crops and the remainder 6-7 in. deep for barley and oats. The soils were light to medium loams; some loose, some stony and some sodden—typical of farming conditions in Scotland.

All the fields were marked out in advance with headland furrows, 9 yd. from the boundaries, with one split furrow to each 44-yd. opening to serve as guides during the night operations. Most of the work was carried out in third gear, with some spells in fourth gear on the lighter fields. The tractors stopped three times a day for normal servicing and refuelling and three times for refuelling only.

The two farmers—John Suttie and David Russell—cut the opening furrows at 11.30 a.m. on the first day and two young farmers from New Zealand, Rex Dobson and Ross Orr, finished at exactly the same time on the fourth day. There were four regular drivers and one relief to each tractor—10 men in all—and they worked in pairs on eight-hour shifts, each man doing a spell of two hours at a time.

Results of the trial

The following are the records of performance:

Machines used:

One 'Dexta' and one 'New Dexta' 32-h.p. light tractor.

Standard F.R. three-furrow and four-furrow mounted ploughs.

Work done:

204.2 acres in 100 hours, or 1 acre per hour per tractor.

49.1 acres were ploughed 10-11 in. deep.

155.1 acres were ploughed 6-7 in. deep.

Fuel consumed:

227 gal., equal to 1.10 gal./acre or ½ gal./acre/tractor.

Performance:

The fields were ploughed completely and all short ends and headlands were finished correctly; the implements were raised and lowered 6,000 times and in all turned over about a quarter of a million tons of soil in 100 hours.

Conclusions reached

The lesson to be learned from this timed performance trial, carried out under normal conditions, is of vital importance to the farmer whose normal programme has been upset through prolonged and heavy rain, making it impossible to take machines on to the waterlogged land. By working round the clock when the soil is in the right condition it is possible for him to catch up on the time lost and so still plant early in the spring.

This endurance trial is of no less importance to farmers in the more arid regions of the world, where it is essential to make the most of rains of short duration and turn in as much moist soil as possible before the hot sun can dry up the surface moisture. In such cases, by working day and night, it is possible to turn over two or three times as much land in a day by operating in shifts.

Finally, there is the agricultural emergency—a five-year or seven-year plan which is running behind schedule. What is to be done? It is apparent from this trial that by working round the clock it is possible to cover at least twice the acreage, providing the land is available. In this way any crop deficiency in one year can be made good in the next, for this prolonged endurance trial has proved that the modern tractor can 'take it'.

Summing up

Too much and too little rain are normal hazards of farming the world over. By working round the clock it is possible to do more work with the same number of tractors, to meet agricultural emergencies, and to create additional employment by operating in shifts in order to be able to cover a greater acreage of land in a limited period of time.

Holding the Soil

While farming in New Zealand has been strikingly successful in terms of output, it has caused serious soil erosion and increased flooding in many areas. New Zealand is rugged and geologically immature, and has comparatively little flat land. The replacement of forest by grass, burning of vegetation to control weeds or second growth and trampling by countless hooves have decreased the countryside's capacity to absorb rain and have increased run-off. Resultant erosion and flooding have reduced the agricultural and pastoral value of considerable areas.

The Soil Conservation and Rivers Control Council was formed in 1941 to organise catchment boards to deal with erosion, river control and drainage; arrange Government financial assistance for such projects; set standards, and supervise work.

Catchment boards

Thirteen democratically constituted catchment boards, each responsible for the conservation of the complete catchment area of one or more rivers, now cover much of the country. The Waikato River, the catchment area of which is 5,505 sq. miles or one-twentieth of the country's area, is controlled by an independent local authority. Catchment commissions are also being formed in the remaining areas.

The catchment board staff prepares river control schemes, estimates and economic reports to justify proposals and assess likely benefits. After being approved by property owners, these reports are checked by the Soil Conservation and Rivers Control Council. The Government may then supplement the money raised by the catchment board by as much as three to one. In the year ended 31 March, 1960, subsidies for river control exceeded £800,000.

Flood control

In 1960 there were 22 major river control schemes in operation or about to begin.

On the east coast of the North Island the Poverty Bay Catchment Board has almost finished a control scheme for the Waipaoa River. Extremely fertile river flats, which were formerly frequently flooded, now support extensive market gardens. The river flooded recently and, although the control works were incomplete, there was little damage.

The Wairarapa Catchment Board in the south-east of the North Island has recently received approval for a scheme estimated to cost £2½ million, which will divert part of the Ruamahunga River and reclaim a portion of Lake Wairarapa and surrounding swamps.

Soil conservation

The Soil Conservation and Rivers Control Council encourages and assists catchment boards and farmers to carry out soil conservation. In 1959 the Poverty Bay Catchment Board, which has some of New Zealand's worst eroded country in its watershed, sponsored a £2 million reforestation scheme to prevent hillsides from slipping. Soil conservation is also being carried out on farms in the district; trees are being planted in gullies and dams built to trap debris, overgrazing is discouraged and better farm management methods are being introduced.

The Council also selects farms whose owners are willing to operate them as demonstration centres and assists them to prepare maps showing land use capability; financial assistance and labour are provided to put these measures into effect.

Research and demonstration

In 1960, the establishment of a Tussock Grasslands and Mountain Lands Institute was approved to co-ordinate and develop research into soil conservation in the South Island's mountain backbone, where severe erosion begins the cycle which leads to flooding in the valleys and plains.

In 17 experimental and demonstration areas sound conservation and farming practices, applied to eroded countryside, are being used as examples for farmers. There are also research areas where run-off, soil logs and the effects of differing management methods and types of vegetation are being investigated.

SEYCHELLES CINNAMON

J. F. G. LIONNET*

Cinnamon is a small evergreen tree belonging to the order Lauraceae. The leaves are large, ovate-oblong in shape, and the flowers, which are arranged in panicles, have a greenish colour and a rather disagreeable odour.

Photo: M. Fayon

A Seychellois girl plucking freshly cropped cinnamon leaves

THE cinnamon plant is reported to have been introduced into the Seychelles from the East Indies in 1771 by order of Pierre Poivre, who resided in Mauritius (then the Ile de France) and was the Intendant of all the French colonies beyond the Cape of Good Hope. This variety was later accepted as being the best of Ceylon cinnamon and was named accordingly —*Cinnamomum zeylanicum*.

Propagation and distribution

One of the original propagators of the plant in the Seychelles must have been the endemic fruit pigeon, *Alectroenas pulcherrima*, which feeds on cinnamon fruits. Vanilla planters, in the heyday of vanilla, may also have helped to spread cinnamon inadvertently by growing it as supports for their vanilla vines. The main propagator today is the ubiquitous Indian mynah bird, *Acridotheres tristis*, which feeds on the fruits during the fruiting season, from February to April.

Cinnamon grows semi-wild and is exploited on four of the 28 granitic islands of the Seychelles group; it seldom occurs on the rest of the granitic islands and is absent from the 64 coral islands. On two of the largest and highest islands, Mahé and Silhouette, which have some 100 in. of rainfall per annum, it is the dominant species of the secondary vegetation which cloaks the higher and middle slopes, and occurs also as intercalary or interplanted vegetation in the coconut groves of the lower slopes and even of the calcareous coastal flats, where it is considered beneficial by certain planters on account of its penetrating roots, which are believed to tap plant foods from the deeper soil layers.

Photo: M. Fayon

A large cinnamon tree on Mahé

On the other two and smaller islands (Praslin and La Digue), where cinnamon occurs and is exploited, rainfall is only about half that on Mahé and Silhouette; as a result, cinnamon is very slow in spreading and far from abundant. While on the top and rather inaccessible parts of the islands cinnamon grows under forest conditions and reaches 2 ft. in dia., on the middle and lower slopes, it usually occurs in the form of irregularly spaced bushes, which are regularly cut back for leaves and bark.

Of the Seychelles islands, Mahé is by far the largest producer of cinnamon leaf oil and cinnamon bark. Little is produced on Silhouette on account of the difficulties of harvesting the crop, due to the very steep slopes and rocky terrain. The total acreage under cinnamon in the Seychelles is estimated to be 20,000 acres.

Cinnamon is the second in importance of the Seychelles industries after copra, the two principal products being cinnamon bark and cinnamon leaf oil. The former goes to the spice industry. The latter, which contains 85-95% eugenol, is mainly used for the manufacture of synthetic vanillin.

* Director of Agriculture, Seychelles.

CINNAMON BARK

At the beginning of the present century, when the Seychelles vanilla industry collapsed due to anthracnose† and to the advent of synthetic vanillin, the Seychellois planters turned to cinnamon, which had invaded the deforested slopes of the larger granitic islands and had hardly been touched.

The then existing cinnamon trees were cropped for their bark. As they were large trees which yielded good crops, their exploitation was remunerative and was carried out ruthlessly, mainly by felling or stripping of the standing trees. As a result in a matter of eight years, most of the older trees had been stripped and were badly mutilated or dead, and the younger trees did not yield enough bark.

Thus, in 1908, which was the first year that cinnamon bark was exploited, the record export of 1,202 tons occurred, whereas by 1915 the annual exports had dropped to some 190 tons.

Photo: C. J. Piggott

The operator in the foreground is stripping the bark and the others are rolling, trimming and bundling the quills

From 1915-1922 the average annual export was 125 tons and for the next 20 years it amounted only to 50 tons.

Since 1942, due to short supply of cassia bark from China, Indo-China and Indonesia, there has been a recovery of the Seychelles cinnamon bark industry, which culminated in the export of no less than 1,063 tons in 1958, the highest export figure since the record shipment in 1908.

Types of bark

Three main types of cinnamon bark are produced in the Seychelles: *unscraped bark*, which consists of dry pieces of bark of different sizes and thicknesses, obtained from bushes of various ages; *scraped bark*, which is usually made from younger and therefore thinner barks, whose outer corky layer has been scraped off before drying in the air; and *cinnamon quills* and *quillings*, which have been exported only recently and which consist of thin scraped barks tightly rolled or, in the case of quillings, of broken quills and quill trimmings which have been dried in the shade.

Except for the quills, which are made from bark which has been detached from the stems by means of a curved knife, cinnamon bark, rough or scraped, is usually beaten off the cinnamon stems by women workers who are paid piece-work rates related to the prevailing price of the finished product and the distance that the fresh undried bark has to be carried by the croppers. As with cinnamon leaf, the fresh bark must be transported as a head load owing to the difficult terrain. Both the scraped bark and the quills are scraped before removal from the stems. Rough bark is often dried in the sun, while the fine scraped bark and the quills and quillings are air dried under sheds. They are usually exported in wooden boxes containing 200-300 lb.

The Seychelles fine-grade cinnamon quills, although not of the reputed standard of the Ceylon product, have nevertheless attracted attention on the London market in recent months.

Method of cropping

The bark is usually cropped the whole year round at the same time as the leaf. In the more easily accessible areas, where leaf is cropped every 18-24 months, the yield of bark is usually too small to warrant cropping, except when prices are very high; in other areas which are difficult to exploit and which can only be cropped for leaf at intervals of five years and over, economical yields of bark are usually obtained. The tendency, therefore, is to crop the lower cinnamon areas for leaf only at short intervals and the higher areas for leaf and bark at longer intervals.

Seychelles cinnamon bark is produced by large as well as small producers, who usually have only a few acres, while the large producers may own several hundred acres. The smallholders usually sell their produce to large producers or to the exporters; the large producers either export it themselves or sell to exporters.

Yields

The yield of cinnamon bark per tree varies greatly, depending on the age and size of the tree. Large trees, reaching 2 ft. in dia., have been known to yield up to 100 lb. of dry bark, while younger and smaller trees yield 10 lb. or even less. The yield per acre also varies considerably and again depends on the age of the trees and spacing, which is naturally very irregular. An average yield of about $\frac{1}{4}$ ton per acre every five years can be expected.

Depending on the age of the trees and the altitude at which the trees are growing, the proportion of the dry cinnamon bark to fresh leaf varies from 1 : 12 to 1 : 1 by weight. For the very thin bark from which quills are made, a proportion of 1 ton dry bark to every 100 tons of fresh leaf may even be obtained.

† Diseases caused by fungi belonging to the genera *Colletotrichum*, *Gloeosporium* and *Marssonia*.

Trimming of cinnamon quills

Utilisation

The quality of Seychelles cinnamon bark is strictly controlled by Government before export. Export permits are only delivered in respect of clean, dry bark containing not more than 1.5% foreign matter and 15% moisture. The product is exported in jute bags, in lots of 1-10 tons, and goes mainly to the spice industry, being ground into cinnamon powder for blending with other types in the preparation of ground spices, where it usually competes with cassia barks obtained from *Cinnamomum cassia* (from China) and *Cinnamomum loureirii* (from Indo-China).

The U.K. and other European countries used to be the main importers, but, due to the short supply of cassia bark from the East, the Seychelles produce is now exported to other parts of the world.

CINNAMON OILS

Although the first distillations of cinnamon oil were carried out in 1906, it was only about 1915 when cinnamon bark was no longer available in large quantities, that they became extensive. At first both bark and leaf oils were distilled, but, although a sizeable export of cinnamon bark oil took place in 1916, when 18,314 litres were exported, the cinnamon bark oil industry was only short-lived.

Bark oil

The oil obtained from the bark is rich in cinnamaldehyde, $C_6H_5CH{=}CHCHO$, containing as much as 75% of this substance, but its flavour is not considered to compare with that of the Ceylon product and it is relatively insoluble in alcohol. As a result it has not been able to establish itself in the essential oil market.

By 1916, however, 15 tons of leaf oil were being exported annually from the Seychelles. From 1925-1950 the average annual export was 60 tons, while during the last 10 years it has been over 80 tons.

Leaf oil

Cinnamon leaf oil is now obtained from the freshly cropped leaves some 24 hours, but usually not more than a week, after cropping, as the yield of oil decreases rapidly if processing is delayed.

The leaves are hand plucked from the stems of the cinnamon bushes which have been slashed down to 18-24 in. from the ground. Cropping is carried on the whole year round, except during flushing, which occurs at the beginning of the rainy season, in October or November. The present method of restricted cropping, which was adopted in about 1930, encourages the production of new shoots and results in heavier crops subsequently.

The plucked leaves are packed in gunny bags and, as with cinnamon bark, are transported as head loads to the distilleries or to roadside collection points. The price paid to the croppers again varies with the accessibility—the distance of the cropping field and the price of the finished product. Cropping is usually done by women, but sometimes also by men as overtime work.

As for cinnamon bark, cinnamon leaf is produced by both large and small producers. The former distil the cinnamon leaf oil in their own distilleries, while the latter sell their leaf to the large distillers, who either sell their oil to exporters or export it themselves.

Yields

The yield of cinnamon leaf per bush and per acre varies considerably, depending on site, age of bush, intensity of plantation and cropping rotation. An average yield of about $\frac{3}{4}$ ton per acre per annum is usually obtained.

The distilleries

There are two types of essential oil distilleries in the Seychelles: the primitive under-fire type and the boiler type. The former is a relic of the past and is usually found in the more inaccessible places, where the terrain and the distance make the transport of the cropped leaf prohibitive.

The boiler-equipped distilleries, in which steam is generated at atmospheric pressure or under pressure, are usually much larger than the direct-fired type and are located on readily accessible sites beside the roads. There are about 50 essential oil distilleries in the Seychelles.

The extraction of cinnamon leaf oil is by cohobation‡—the aqueous distillates, which contain suspended oil, being returned to the stills after separation from the oily fraction. The yield of oil per ton of leaf varies considerably, depending on the material, the time of the year and the efficiency of processing. An average yield of 0.6-0.8% is usually obtained.

The cinnamon leaf oil, when freshly distilled, is straw coloured, slightly heavier than water and corrosive. When stored in iron containers—as it usually is—it will dissolve iron and become dark in colour. It usually contains about 90% phenols, which consist almost entirely of eugenol or caryophyllic acid, $C_{10}H_{12}O_2$.

‡ Cohobation: steam distillation pouring back the watery top layer repeatedly.

Photos: M. Fayen

Left: *Bags of cinnamon leaf waiting to be taken to the distillery.* Right: *This primitive distillery is fired by coconut husks and fronds. Oil is extracted from the leaves and the spent leaves are used as a mulch for the coconut palms*

Table 1

Characteristics of Seychelles cinnamon oil

Specific gravity at 15°C ..	1.206 to 1.0604
Optical rotation at 20°C	—2.53 to —1.45
Refractive index at 20°C	1.533 to 1.537
Phenols	85 to 95%
Solubility in 70% alcohol	Soluble in 1-1.5 volumes

Uses of cinnamon oil

The leaf oil is usually used as a flavouring additive, as an ingredient in perfumes and as a source of eugenol. Seychelles cinnamon leaf oil competes on the essential oil market with Ceylon cinnamon leaf oil and Madagascar clove leaf oil. Due to its better flavour, the Ceylon oil is perhaps to be preferred to the Seychelles product as a flavouring agent, but as a source of eugenol the Seychelles product is in better demand than either of the competing oils because of its higher content of eugenol, which is used as a raw material for the production of synthetic vanilla.

Exporting and marketing

The quality of cinnamon oil is strictly controlled before export. Every container of oil deposited for export is sampled and examined by the Government chemist and export certificates are issued only for the genuine unadulterated product, which is usually shipped in 40-gal. iron drums in lots of 1-5 tons.

At one time all Seychelles cinnamon leaf oil was sold through a single agent in London. This system of sales was discontinued in 1957 and it is now sold through three selling agents—two in the U.K. and one in the U.S.A.

Up to 1950, although exported also to the U.K. and Europe, the product used to go mainly to the U.S.A. Due to the advent of lignin-vanillin, much less is exported there now. The losses in this market, however, have been offset by increased exports to the Netherlands and the U.K. and by the establishment of new markets in Germany, France, Japan and even Spain and South Africa.

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More Grants for Agriculture

Under the Colonial Development and Welfare Acts altogether £5,685,198 has been approved for schemes to benefit Britain's overseas territories.

The largest of the agricultural grants was £450,204 to *Kenya* for surveys necessary for land consolidation and planned farming under the Swynnerton Plan for the development of African agriculture. A grant of £224,421 has similarly been approved for African land reorganisation in *Nyasaland.*

Grants totalling £211,378 have been made towards the cost of agricultural research in *Tanganyika.* It is proposed to appointment staff to undertake farm economics studies and for the establishment of a network of sub-stations to be attached to four agricultural research centres.

Zanzibar will benefit by a grant of £91,162 towards the cost of developing its agriculture and fisheries. Projects include £28,922 for stock improvement and £25,041 for a mechanical cultivation project which provides for the hire of tractors by individuals and co-operative groups in the preparation of fields for rice and other crops.

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

Coffee

Botany, Cultivation and Utilisation

J. J. NJOROGE, B.SC.

The latest of the WORLD CROPS *series—'Coffee'—is due to appear this month. The author, Dr. F. L. Wellman, is pathologist in charge of the Coffee Research Project in Puerto Rico. This digest of the book was prepared by a Kenya African now on study leave in Britain.*

A tree of the canephora *species of coffee in blossom. It is from this species that* robusta *coffee was developed. Guatemala*

THE trees that produce the coffee of commerce belong to the genus *Coffea*; the exact number of species seems to depend upon which botanist is accepted as the authority. Some say there are about 50, while others believe there are more.

Although some species are bushes or trailing plants, most of them may be classed as trees. Some are surface rooting; others habitually penetrate deep in the soil. They have opposite leaves and opposite branches. There are two types of stem growth: the vertical, vegetative part of the tree structure from which buds arise to produce horizontal fruiting branches. The flowers are quite irregular in many respects and the fruit is a drupe, usually containing two seeds.

Coffee varieties

By far the most important species of cultivated coffees are, first, *C. arabica*, then *C. canephora*, with *C. liberica* and *C. excelsa* equally a poor third in popularity. The most notable difference between these species lies in the size of the seed. A pound of *arabica* contains approximately 1,200 dry seeds, a pound of *canephora* approximately 1,600 and one of *liberica* about 800. The popular *arabica* coffee, which is believed to have originated in Ethiopia, comes from heavy-bearing trees and the beans have a flavour which is described as 'aromatic'.

The small *arabica* tree, with small flowers, has a chromosome number of $2n = 44$; it is self-fertile and so does not need wind or insect pollination. *C. canephora* and *C. liberica* have large blossoms; they both have a chromosome number of $2n = 22$ and are largely self-sterile, and so need to be cross-pollinated by wind and insects.

C. canephora is more variable and resistant to rust disease. It was first planted about 1900 in Java and other Indonesian islands, where it was introduced from Africa as a replacement for *arabica*, which had been completely wiped out.

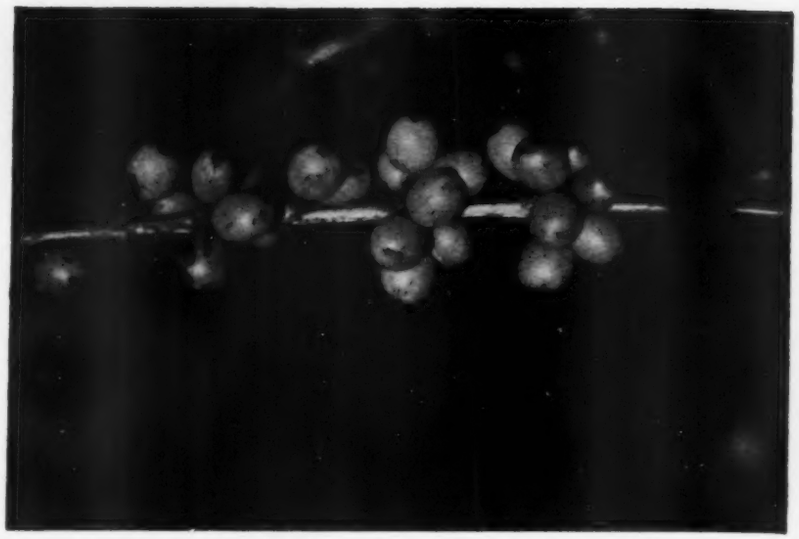
The name *robusta* was given to it in recognition of its resistance to *Hemileia* rust. In commerce this name is much better known than *canephora*, but historical study shows that *C. canephora* was the original name given to it by Pierre in 1895 and that *typica*, *Ugandae*, *canephora*, *robusta*, *Quilloce*, *Maclaudii*, *Stublmanii*, *Bukobensis*, *Naiouli* and *Laurentii* are varieties adapted to different climatic conditions.

Soil and climate

Coffee can be grown on a wide variety of soils, but the crop prefers a slightly acid, deep and well-drained loam, rich in plant nutrients, especially potash, and with an ample supply of organic matter. A great deal of the world's finest coffee, especially *arabica*, is produced on recent volcanic deposits *e.g.* in Costa Rica, deep sandy loams containing adequate humus, though poor in lime. Soils from deeply-weathered lava are used for coffee in one part of Kenya. These are deep and well drained, uniform in texture, slightly acid, rich in potash and poor in phosphorus.

The well-weathered coffee soils of the slopes of the Blue Mountains of Jamaica are drab brown in colour, acid and badly leached. These and similar soils used for coffee in the Congo and the Ivory Coast are produced from conglomerates. Lateritic soils are favoured in Brazil, in parts of the Kenya Highlands and in Java.

As regards its water requirements, the crop is grown under a wide range of conditions. In the best coffee areas in Brazil the rainfall is from 30-40 in. and sometimes may even be less. Much *arabica* coffee is grown where the rainfall is around 75 in. It has been stated by Vegeler (1933) and Livens (1951) that coffee needs about 60-90 in. a year. However, in cool locations with abundant cloud and good soil mulch a rainfall of much less than 60 in. will be sufficient. Conversely, both *arabica* and *robusta* coffees can be grown successfully where the rainfall is well over 100 in. a year.



Cherries of the Arabica *variety. About half normal size*

Nursery practice

Coffee is usually planted in prepared nursery beds, though in Brazil the general practice is to plant the seed directly in the field. Seedbeds are always carefully levelled and well drained, and are usually shaded to ensure moisture retention. The beds are generally about 40 in. wide with 18-in. lanes between beds, and in wet areas they are raised.

Seedlings stay in the nursery for varying lengths of time. Some prefer the young trees to be about 18 months old for transplanting, while others consider four to six months to be ample time in the nursery. The seedlings are transplanted into large holes which have been previously dug in the field.

Spraying to control rust disease in Mysore, India. The spray is directed on to the undersides of the leaves

Size of plantations

In a large number of coffee countries planting is in well-ordered rows. In the Cameroons, Uganda or Urundi growers may own from 50-100 trees, while in countries such as Hawaii, Costa Rica and Colombia the smallholdings range from 5-30 acres. In general, where the conditions are most favourable the farms may vary from as little as two up to many thousands of acres.

Pests and diseases

The hot sun and grasses appear to be the serious enemies of neglected coffee although certain broad-leafed weeds are also competitors with coffee for soil nutrients and moisture. Under clean-weeded conditions soil temperatures during hot, dry weather can approach the danger point for coffee roots. Mulching, the use of covers or shade trees can prevent this.

The classic disease of coffee, known as *Hemileia vestatrix,* is by far the most important of all the diseases described by the author and the most feared. This rust disease, which still causes serious losses, was responsible for destroying the entire coffee industry in Ceylon between 1869 and 1890. It has been, and still is, controlled with Bordeaux or a similar mixture.

World production

The coffee areas of the world fall roughly into four camps. Brazil, the greatest of the producers, stands alone with something like 40% of the world's coffee. Colombia comes second, producing about 20% of the total. An equal proportion comes from the Federation of Coffee Growers of the Americas, which includes almost all the producers of tropical America, excluding Brazil and Colombia. The fourth is Africa and Asia, an increasingly important region which produces the remaining 20% of the world's supply. Over-production has led to recurring coffee price crises and it would seem that the solution to this problem lies in international regulation of the amount of coffee to be grown.

This book by Dr. Wellman contains a wealth of information for the research student as well as the farmer.

Weed control with 'Fernoxone' (a 2,4-D formulation) in Guatemala

Making Better Hay

Film produced by Fisons Studio, in co-operation with Fison's Technical Advisory Service in sound and colour. Time 25 min.

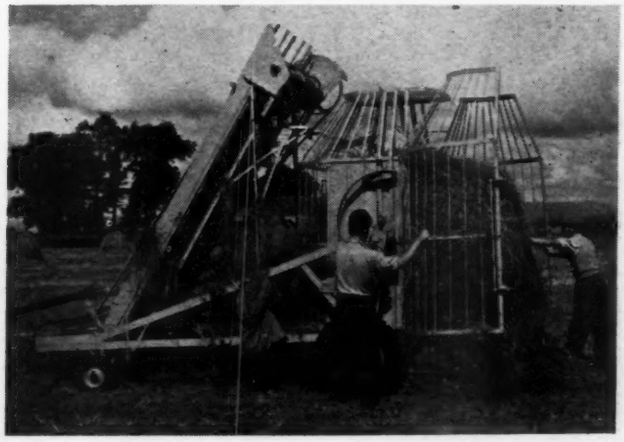
Hay is still the basic winter feed on most British livestock farms, according to a recent survey which has shown that 83% of the farmers depend entirely on haymaking as a means of conserving grass for winter feed.

This colour film emphasises the importance of hay and indicates the factors which help to make hay the best, most economical and most portable of all bulky fodders for winter feed.

These factors are suitable fertiliser treatment to promote rapid leafy growth, rich in minerals; grazing before laying up for hay to avoid massive crops which are difficult to harvest; and, above all, mowing at an earlier stage of growth, for every week's delay after the flowering stage is reached can result in a drop of 2% in the crude protein content.

The early and repeated tedding of the swath is advocated to enable the wind, as well as the sun, to kill off the living plant quickly, and some of the latest power-driven tedders are shown in the film. When mowing is followed closely by tedding, rapid drying is effected with least loss of food value, and this procedure can often speed up the haymaking by 24 hours.

Methods of getting the hay off the ground, from hand piking to mechanical piking, and the making of ventilated pikes by hand and machine are attractively presented in the film. The green leafy hay from the pikes is shown being moved by various devices from field to stockyard.



Stills from the film. Left: *a hand-made pike is finished off on a Lanarkshire farm.* Right: *a mechanical piker, commonly used in Stirlingshire, which can put up 20 pikes an hour, each containing about 5 cwt. of cured hay*

Useless Heath becomes Fertile Land

Large areas of heathland have been reclaimed for agriculture in Holland. The experience so gained can be applied in other countries.

ONE of the most striking features of the Dutch landscape is the low level of the land. If the visitor does not go to the eastern provinces, he will return with the impression that Holland has been won entirely from the sea and is a country where ships sail in the canals high above the surrounding land.

Actually this is only one aspect, for further to the east the country is very different. The visitor can wander for hours in the Veluwe or the Handsrug and through the forests and moors of Drente, and meet hardly a soul.

Fifty years ago much of the country was wasteland; in fact, the name Holland means 'houtland' or 'woodland' and this indicates the profound change in the nature of the country. The Netherlands is today one of the three most densely populated countries in the world and it is vital for the Hollanders to obtain the highest possible yields and reclaim new lands for agriculture wherever possible.

An account of the land which has been won from the sea was given in the May and June issues of WORLD CROPS. Less spectacular, but no less important, has been the task of converting the wastelands into good agricultural land—work which has been carried out by the Netherlandsche Heidemaatschappij (Dutch Heath Co.).

The first step in converting useless heathland into pasture is rotavation. This produces a loose seedbed for approved types of grasses

This non-profit-making organisation, which was created in 1888, has tackled the problem of the wastelands of Holland so energetically that, except for a few small areas preserved for recreation, no more land is available for conversion into orchard, cornfield or grassland.

Instead of passing out of existence, the company has become a huge organisation with the more appropriate name of the *Netherlands Land Development and Reclamation Society* and it now operates not only in Holland, but also in other countries. It functions partly as an engineering concern and partly as an advisory and managerial organisation.

Its activities include: reclamation of fens, moors and marshlands; improvement of water control in agricultural areas; drainage of arable lands by means of open or closed (subterranean) systems; improvement of water supply for agricultural lands by irrigation or raining systems; consolidation of scattered land holdings; provision of farm buildings; construction and improvement of country roads; afforestation, reafforestation and forest management; improvement of fresh-water fishing; and the design and construction of recreation centres, sports grounds and playgrounds, swimming pools etc. The Society also manages estates, farms and fisheries.

The latest developments in agricultural machinery and farming methods are examined and tested and the knowledge and experience, so gained, is passed on to the members of the Society through its monthly review, bulletins, refresher courses and training centres.

The second step in reclamation is sanding. Here a powerful machine is used for bringing up sand from below and spreading it over the land

(*Continued on page 272*)

Left: *A co-operative pulping factory. Note drying trays on the left of the picture.* Right: *Part of the same factory with fermenting tanks in foreground. After soaking, the 'cherry' passes down for pulping*

Peasant Coffee Production in Kenya

E. S. CLAYTON,* B.SC., PH.D.

THE production of coffee on estates has long been a well-established industry in Kenya, while the peasant coffee growers of Uganda and Tanganyika also have flourished since the 1930s. By contrast, the Kenya peasant has lagged well behind his neighbours. He cannot, of course, be blamed for this, because it was mainly the outcome of Government policy at that time.†

It was not until the 1950s that the African farmer in Kenya began to take coffee seriously. A small acreage of coffee was planted out in Central Province before the last war, but this new development was strongly objected to by non-African growers for a number of reasons. They maintained, for example, that badly-tended coffee plots would be breeding grounds for pests and diseases and that the export of badly prepared native coffee would damage the reputation of the estate product.

There may have been something in these protestations because the production of disease-free, high-quality coffee by peasant growers requires a high level of technical supervision and this was not then available. But, whatever the truth of the matter, official policy took heed of these objections, with the result that the African was not encouraged to grow coffee or, for that matter, any other high-value cash crops until after the last war.

Planned progress

In 1946 a start was made to foster cash-crop production by Africans in suitable areas, coffee being by far the most important of such crops. This change in Government policy arose from the fact that a large number of cultivators had been brought into contact with a money economy during the war, with the result that progress was considered by them as being synonymous with increased cash incomes. These could only be obtained by growing high-value cash crops.

However, marked progress in the extension of African-grown coffee did not arise until the appearance of the well-known Swynnerton Plan.‡ This blueprint of agrarian reform rested on three props: land consolidation, farm planning and the rapid expansion of cash crops. And with regard to *arabica* coffee, it set the following targets:

1953	..	4,000 acres
1958	..	18,000 acres
1963	..	43,000 acres
1968	..	71,500 acres

The areas suitable for *arabica* production lie between 4,500 ft. and 6,400 ft., with between 37 in. and 55 in. of rain, and are situated in Central and Nyanza Provinces, Kericho, the Kisii Highlands and Machakos.

The progress made within the colony is shown in Table 1:

Table 1
Progress of coffee growing by Africans in Kenya

Year		*No. of growers*	*Acreage*	*Value (£000)*
1935	..	n.a.	103	n.a.
1945	..	786	318	n.a.
1951	..	8,208	1,735	n.a.
1952	..	11,864	3,038	n.a.
1953	..	15,019	3,867	147
1954	..	18,806	5,339	292
1955	..	24,486	7,511	310
1956	..	39,408	12,052	485
1957	..	61,990	16,783	992
1958	..	75,482	20,301	1,130
1959	..	89,153	26,161	2,181

It will be seen that actual expansion has been substantial and has, so far, exceeded the original target acreages, with the result that over £2 million now flow annually into the pockets of some 89,000 peasant cultivators and their families. In the near future an even greater flow of wealth is likely to arise, providing prices and quality hold, as more planted acreages come

* Wye College, University of London.

† Influenced, no doubt, by the memory of coffee disease in Ceylon which wiped out the industry there.—Ed.

‡ Swynnerton, R. J. M.: 'A Plan to Intensify the Development of African Agriculture in Kenya', p. 15, Government Printer, Nairobi, 1954.

into bearing. So successful has this aspect of development been that in 1960 the Government embarked on an 'accelerated cash-crop development programme' which sets even higher target acreages.

Organisation of processing

The expansion of the coffee acreage requires a similar increase of processing capacity to convert the 'cherry' into 'parchment'. The need to maintain a balance between acreage expansion and the erection of pulping factories is, of course, vital to the future development of the coffee industry. And, for this reason, it is considered imprudent to leave the processing side to chance—that is, to private enterprise—and so the overall planned expansion is controlled by the Government.

Pulping factories are erected at strategic points and are each designed to serve 200 acres of mature coffee. Since most of the cherry is transported to the factory as head loads or by pack animals, the aim is to site the factories at a maximum of three miles from the farthest grower.

The factories are financed by Government loans and cost between £1,500 and £3,000 to build. Most of the factories use a three-disk pulper with rotary screens, powered by a 3¼-h.p. engine. After pulping and drying, all the parchment goes to the Nairobi mills for hulling prior to export.

To date 135 of these factories have been erected; they are run by Africans on a co-operative basis and membership is compulsory for all growers. As expansion continues new mills situated in the growing areas will become economically justified, as they will save freight charges on the movement of waste parchment, which comprises 20% of the product by weight and 30% to 40% by volume.

Price and quality

It might be thought that the problem of raising rural incomes was solely a matter of increasing the production of coffee. Should this be so, Kenya is well on the way to success; but incomes depend not only on output, but also on the price received on the world market, and this depends above all (ignoring general price trends) on *quality*.

So far the African grower in Kenya has produced high-quality coffee and received a high average price for it. About 60% of the peasants' crop fell in the top three grades in 1959-60. But the market heavily discounts the lower-grade coffees and if, for example, the quality of Kenya coffee fell to that of her neighbouring peasant growers in Uganda and Tanganyika, through poorer cultural and processing methods, her income could well fall by some £½ million at the current output.

Consolidated holdings of young coffee in Kiambu.

So long as present-day quality can be maintained, therefore, Kenya *arabica* coffee will receive a premium on the world market, being favoured as a blending coffee because of its acidic quality. The maintenance of quality is, consequently, a major problem of the peasant coffee industry. This problem has two aspects: one of internal and the other of external significance.

Improving quality

The standard of processing in Kenya is high, so the production of quality coffee is largely a matter of achieving high cultural standards. The problem, therefore, is that of persuading thousands of peasant growers to attain these standards. Unfortunately, the best weapon of persuasion—price incentives—cannot be used directly. Because all the cherry is bulked together during processing, the individual grower is screened from the world market grade differentials. There is, however, an indirect effect because co-operatives receiving high-quality cherry will tend to make higher pay-out prices to their members—even to those whose quality is not good.

This cannot be as effective as a direct quality incentive price to the individual grower and, in consequence, the Government has to rely on the provision of supervisory and extension services to foster the production of high-quality coffee.

So far general field supervision has been very effective, but there is a danger that it will become less effective as the 'accelerated cash-crop expansion programme' gets under way and increases the demands on the supervisory services, for it will mean that they will then be spread more thinly on the ground, which will almost certainly lead to a fall-off in crop quality. The expansion programme will also mean that field officers will be less able to use their discretion to prevent the indolent farmer from growing coffee or, if he already does, from extending his coffee acreage. This has been, in the past, a useful deterrent in the fight for quality maintenance.

To combat these dangers the Government is trying to encourage coffee co-operative committees to promote the improvement of quality. It is also trying to persuade suspicious African politicians, with the idea of gaining their active support, that a successful policy of quality maintenance is in the interests of the country as a whole. It is to be hoped, in this respect, that considerations of general welfare will come before narrow, sectional interests.

Over-production of lower grades

The external aspect of quality is, of course, outside the Government's control. As mentioned earlier, Kenya *arabica* is much favoured, but only so long as it is graded into the first three classes. In lower grades, it loses its special advantages and has to compete with other *arabicas*. Indeed, most of the world's *arabica* coffee, of which Brazil is the major producer, falls below the top three classes in quality. But there is substantial over-production of inferior qualities and this situation has recently led to the introduction of an international restriction scheme which aims at maintaining the price of lower grades.

Over - production of lower - grade coffees has naturally led to wide quality differentials in price and recently to the imposition of export quotas which, to date, it has not been necessary to apply to Kenya's high-quality coffees. It will be seen from Table 2 that any significant fall in average quality means a disproportionate fall in growers' incomes due to the two factors of price and export quota.

Table 2

Kenya coffee prices by class, 1959-60 season

Class	*Price £ per ton*	*£s per ton below Class 1*
1	543	—
2	528	15
3	485	58
4	443	100
5	385	158
6	350	193
7	316	227
8	304	239
9	300	243
10	289	254
11	269	274
12	219	324
13	138	405
14	50	493

As far as processing is concerned, low quality results mainly from the use of 'dry' methods, whereas Kenya uses 'wet' processing. A determined policy on the part of some of her competitors to change over to wet processing could well reduce the premium now enjoyed by Kenya coffee. The erection of numerous pulping factories would require capital and it would not be easy to persuade peasant growers to change their methods, but one could expect other *arabica* producers to move in this direction.

Harvesting coffee cherry on an African smallholding in Kiambu

The situation facing Kenya is that any competing country which improves its cultural and processing methods could readily attain higher quality and thus compete with the Kenya product. Hence the continued favourable position of the Kenya grower is not at all certain, for it depends on the responsiveness of foreign competitors to quality incentives. Fortunately, so far the response has not resulted in serious competition.

More capital needed

The continued expansion of Kenya's coffee industry is vital to her economy, but this expansion depends on the availability of capital. The cost of establishing an acre of coffee is approximately as follows:

Table 3

	£
537 seedlings at 50 cents each	13.5
Loss of crops (for three years)	75.0
	88.5

These costs include the purchase of coffee seedlings from the nursery and the value of crops lost in the pre-bearing period, but they exclude any labour or fertiliser costs. If the planned coffee acreages are to be achieved, then, at nearly £90 an acre, a large amount of finance capital will be required. An investment of £90 an acre is, of course, justified in relation to an expected annual return of £200 an acre (10 cwt. parchment an acre at £400 a ton), but these capital sums are more than the Government can provide.

Reinvestment from profits

Since 1954 Kenya has been fortunate in receiving outside help in the form of grants to finance her agrarian developments and cash-crop expansion. Now, however, these are more difficult to come by and it looks as though the peasant coffee growers will have to finance the expansion of their own industry. That is, part of the higher incomes now received from coffee must be invested in further coffee expansion.

This emphasises the vital need to maintain high coffee incomes and the critical point of quality maintenance which is so important for high returns per acre. A failure to maintain quality will clearly jeopardise the future of Kenya's peasant coffee industry.

Mangoes May Fly

Discussions are now taking place about the possibility of flying mangoes produced on the coast from Malindi to Nairobi airport. If agreement is reached, this will mean that mangoes can be sent on to London by air and reach Covent Garden market in good condition.

Dates in Morocco

M. BULL

This account of date growing in Morocco shows that it is a very neglected crop in that country and that there is ample scope for research and advisory work to improve the yields and quality of this essential food.

A 'kasbah' on the fringes of the Sahara. These red clay fortresses dominate many oases. From the towers watchmen guarded the palms from the depredations of neighbouring tribes

DATES are to be found growing in the oases on the fringes of the Sahara, south of the High Atlas mountains of Morocco. The main source of livelihood of the Berber tribes who inhabit this hot dry region are the dates growing on the thousands of palms which line the shallow streams or grow over underground rivers.

The date palm, *Phoenix dactylifera*, is believed to be the oldest cultivated tree in history. Directions for growing it have been found on sun-baked clay tablets produced over 5,000 years ago and found in Mesopotamia. Today it still forms the principal food of the inhabitants of the North Sahara and its fringes, as well as of many Middle Eastern countries. Next to the coconut palm, it is the most useful and interesting of the palm family.

Tree of Life

Like the coconut palm, every part is used. The fruit is both nourishing and sustaining because of its high sugar content. Dried it can be kept a long time and, pounded into cakes, it forms the staple diet of travellers in the desert. Dates and milk are the ceremonial offering to welcome guests; dates are also used as fodder in regions where little else will grow, a few handfuls of the dried fruit fattening sheep better than a bale of hay. In some parts *arrack*, an alcoholic liquor, is made from the sap collected from the cut spathes. Some historians think that the date palm was the lotus of the ancients and the Tunisian island of Djerba was once known as the 'Land of the Lotus Eaters'. In these hot arid countries it is indeed the 'Tree of Life'.

Roasted, the long, hard stones are used as a coffee substitute and ground they will yield oil, the residue being fed to cattle. The tall, thin trunks are used for fuel, door posts and rafters where this is the only timber available. The leaves have many uses, from making mats and baskets to thatching; they are also used at Passover and on Palm Sunday in religious services by Jews and Christians and the Moslems use them to build triumphal arches for State receptions. Rope is made from the fibre, while the growing point can be eaten raw or cooked as a vegetable.

Morocco

Morocco has well over a million date palms, but, although the dates are larger than those grown in Algeria and Tunisia, they are of inferior quality. Though no less nourishing, they are less valuable for export. Although the date palm is the chief resource of the Moroccan oases, it is not given the care that it receives in Algeria and Tunisia.

There are several varieties of dates, from the hard dry *medjoul* to the soft, delicious variety known as 'Sultan's Fingers'. Pollinating, instead of being done selectively and by hand, is left to the wind. With proper care the quality of Moroccan dates could be greatly improved, and now that they are increasing their date exports, notably to Spain, this will have to be done.

Conditions of cultivation

The date palm enjoys a hot, dry climate where rains are sparse or non-existent and a sandy or an open alluvial soil, but its fine spreading roots need plenty of water. 'The date palm needs its feet in running water and its head in the fire of the sky'. In the large Tafilalet oasis some 800,000 palms grow on the banks and in the flat valley of the—mostly underground—Ziz River. The source of this river is in the Atlas, but it peters out in the desert to the south. On either side of this oasis is the *hamada*, as these arid, stony plains are called, and beyond barren mountains stretch to the horizon.

Each family plot is surrounded by a low bank and when the rains from the mountains swell the river, irrigation channels take water to each plot in turn. When the water has soaked into the ground the men dig the sandy clay soil under the palms and sow wheat, cabbages, millet and a variety of vetch which is used both as a vegetable and as fodder. This is the only cultivation.

Date planting is equally haphazard, a bunch of dates often being left on certain trees to seed themselves. In consequence, in some places the trees are growing in irregular clumps; in others they are widely scattered. Another way of planting new palms is by cutting off some of the young shoots or suckers which grow out from the base of the trunks. This is done in winter and spring, when they can be kept well watered; if it is not done, they develop into subsidiary trunks producing a clump of palms.

Some six to 10 years must pass before the new trees begin to bear fruit and they are in their prime when 12-15 years old. These beautiful, slim trees grow to between 60 and 80 ft. and their pinnate leaves provide shade for man and beast from the hot sun. They bear either male or female flowers.

When properly cultivated, the pollen from male palms is introduced to the female flowers by hand. The quality of the fruit depends chiefly on controlled pollination between selected palms, cultivation and irrigation. No attempt appears to have been made to manure these palms, except by men and animals seeking shelter from the sun.

Date palms in the oasis near Erfoud, south Morocco. The ground under the trees is flooded after rains have filled the nearby Ziz river

Date palms growing amid olive and fig trees beside the Ziz river in the gorge of the High Atlas Mountains

A single cluster can have up to 200 dates and weigh about 25 lb. Each tree has several of these clusters which grow downwards at the end of long stalks and a fair average crop would be about 100 lb. per palm. Picking is done by hand by the men of a certain tribe who are adept at climbing the tall, knobbly trunks using merely their bare hands and feet with a strap passing round the trunk and under their seat.

The date harvest

The main harvest is in October and November. The commonest variety is picked when light yellow and spread to dry in the hot sun on flat clay floors. Fresh dates are very hard and bitter, but after they have been dried in the sun they become dark brown and rather shrivelled, but are then sweet and pleasant to eat, although very dry.

The best varieties are hung to ripen in the dark inside a closed room and the fruits are eaten or packed when they drop off the bunch. However, as this type is very sticky and juicy, it does not keep well and will ferment if not properly preserved.

Marketing the crop

Morocco is beginning to export more dates, chiefly to France and Spain. Of course, dates are sold by the basket and boxful in the *souks* or markets of all the towns and villages. Prices here vary from 6*d.* to over 2*s.* per lb. The best quality, packed in ½-lb. cellophane packets, cost 2*s.* 6*d.* per packet.

Marketing this crop is still primitive. Each family takes its dates to the weekly *souk*, as the village markets are called. Agents then buy up large quantities for resale to shops in the towns. The best dates grown in the Tafilalet oasis, called Medjoul and Bou Sekri, are bought by the co-operative society set up in Erfoud after independence in 1956. This organisation cleans the fruit and packs it in large wooden cases for export. (I found these very large dates (about 1½ in. long) rather hard and unappetising.)

[*Normally the date palm is vegetatively propagated from the suckers and it is seldom raised from seed. The off-shoots are not usually separated from the parent palm until they are* 3-4 *years old. They are then removed and established in bunded beds in nurseries, where they can be watered at dawn and dusk, or they may be planted at once in the date garden.*

Spacing in organised plantations is 25 ft. x 25 ft. or 28 ft. x 28 ft., according to the fertility of the soil and the size of the crown. This gives either 70 or 55 palms to the acre with square planting. The planting holes are prepared as for coconuts and partly filled with good soil, well-decomposed manure and wood ashes. The young plants are introduced, well shaded and regularly watered.

Due to free cross-pollination, there are thousands of different types of date palms produced from seedlings of mixed unselected parentage and the majority of palms in Arabia and North Africa produce fruit of poor quality and give poor yields.

In modern date culture not only is water used most efficiently, but the palms are properly spaced. A new variety is established by artificial cross-pollination between selected parent palms and a variety, once established in this way, can be propagated vegetatively from the suckers as a clone.

This would appear to offer a useful field for long-term research, for yields could be multiplied several-fold and a more attractive product for export could be produced.—Ed.]

Dates being sold in the Rissani 'souk' or market in the Tafilalet oasis, south Morocco

Useless Heath becomes Fertile Land

(*Continued from page* 266)

Land improvement

One of the machines which are used in the improvement of grasslands is the tractor-mounted 'Rotavator'. Five of these machines are used for destroying the bad grass mat and to produce a seedbed on which approved seed mixtures can be sown. This machine is able to operate at several speeds to meet various requirements, and 2½ acres of heath can be broken down in about four hours.

Another operation is 'sanding'. This consists in covering the land with a layer of sand about 2 in. thick after the grass mat has been broken up by rotavation. This is done on particularly poor soils so that the roots of germinating seeds can spread in all directions and find plant food in the decaying vegetation below.

In a large part of Holland extensive re-parcelling of the lands and the consolidation of smallholdings into larger units are being introduced. The main purpose of these operations is to improve the drainage and road communications in the agricultural areas and to make it possible to carry out agricultural work on a more extensive scale, using modern methods and machines.

Water Conservation in Kuwait

Vermiculite is being used in Kuwait's arid lands for important hydroponic experiments. The problem in such desert regions is not usually the complete absence of water, but the inability of the soil to accept and hold the moisture and air needed to support plant life.

There are two alternative systems of cultivation in such areas—by hydroponics, in which nutrient is fed to the plants rooting in a soilless medium, such as vermiculite, or by the direct introduction of this inert cellular mineral into the top soil (see WORLD CROPS, 1959, **11**, 419).

Vermiculite—a mineral of the mica family—in its exfoliated or expanded state has a concertina laminar structure retentive of air and moisture. It is both non-hygroscopic, *i.e.* it does not actively seek out moisture, and it is an insulant, resisting the direct evaporation of the water it is holding and, to a lesser extent, also shielding the soil below.

The Kuwait Vermiculite Co. have built a full-scale experimental hydroponic installation consisting of 16 concrete tanks each 200 ft. long x 2-3 ft. wide, which are supplied with the required nutrient solution, any surplus being drained off into a reservoir for re-use. Full-scale trials are being carried out with a variety of vegetables and fruits growing in vermiculite to determine what are the most suited to these conditions.

Apart from its use in these hydroponic trials, vermiculite is to be tried as a soil additive. The soil generally is very hard with a low porosity, so that water tends to run off the surface and evaporate instead of penetrating and being retained. The addition of vermiculite will open up the soil sufficiently to permit the entry of air and water.

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Coming Events

Tropical Agriculture.—A Preparatory Course in Tropical Agriculture has been arranged by the Oxford University Committee for Commonwealth Studies from 3-15 July. There will be no charge for the course other than for accommodation in Oxford. Enquiries should be addressed to Mr. G. B. Masefield, Department of Agriculture, Parks Road, Oxford.

The U.K. Branch of the Imperial College of Tropical Agriculture Association will hold an open meeting in London on Friday, July 21. Details from Mr. E. G. Wright, 28 Highfield Drive, West Wickham, Kent.

Russian Trade and Industry.—The Soviet Exhibition to be held at Earl's Court, London, from 7-29 July will present a picture of Russian life, culture, work and achievements in economy, science, technology and agriculture. A particularly large section of the Exhibition will be devoted to agriculture. Further information may be obtained from Industrial and Trade Fairs Ltd., Commonwealth House, New Oxford Street, London, W.C.1.

Agricultural Economics Extension.—The Ninth International Training Centre on Methods and Programme Planning in Agricultural and Home Economics Extension will take place at Wageningen, The Netherlands, from 12 July-6 August. Details may be obtained from the Director, International Agricultural Centre, 1 Generaal Foulkesweg, Wageningen, The Netherlands.

Irrigation.—An International Course on Irrigation in Sub-tropical Regions will be held at Emek-Hefer, Israel, for six weeks from 1 August. Particulars from: Irrigation Extension Centre, Post HaMidrasha LeHaklaut, Emek-Hefer, Israel.

Pacific Science.—The Tenth Pacific Science Congress of the Pacific Science Association will be held at the Universty of Hawaii, Honolulu, from 21 August-6 September. The meeting is sponsored by the National Academy of Sciences, Washington, D.C., and Bernice P. Bishop Museum with the co-operation of the University of Hawaii. The programme is divided into nine main sections: geophysical sciences; biological sciences; public health and medicinal sciences; agricultural sciences; forestry; conservation; anthropology and social sciences; geography; extension work. Enquiries to: Secretary, Tenth Pacific Science Congress, Bishop Museum, Honolulu 17, Hawaii, U.S.A.

Agricultural Science. — The next meeting of the British Association for the Advancement of Science will be held in Norwich, Norfolk, England, from 30 August-6 September.

Section M—Agriculture—will be be presided over by Sir William Slater, secretary of the Agricultural Research Council. The theme for his presidential address will be the revolution in agriculture. Other papers will deal with future developments in farm organisation, farm mechanisation, including automation on the farm and future developments in livestock husbandry and the future of animal breeding. Works visits, agricultural walks, excursions to places of interest and social and civic functions are incorporated in the programme. Overseas visitors are assured of a warm welcome and should write to the Organising Secretary, 18 Adam Street, W.C.2.

Industrial Chemistry.—The 33rd International Congress of Industrial Chemistry will be held in Bordeaux from 1-8 October. One of the 23 sections will be devoted to agricultural science and the food industry. Information may be obtained from the Société de Chimie Industrielle, 28 rue Saint-Dominique, Paris VII, France.

Forest Genetics and Tree Breeding.—To further the aims of the FAO World Seed Campaign, the Forestry Commission will hold a course on forest genetics, tree breeding and seed production at Northerwood House in the New Forest, Hampshire, from 9-13 October. A seven-day study tour of Commission and private forests in England and Wales will take place after the course, provided there is sufficient support. Ten places on the course are intended for landowners, forestry consultants, members of the seed and nursery trade and experienced foresters in Britain and the same number for experienced forest officers from other countries, in particular from Europe, Asia and Africa.

Participants from abroad should be senior officers engaged in silvicultural or tree breeding research or in large-scale afforestation requiring the procurement and treatment of tree seed. A good knowledge of English is essential. The cost of the course, including tuition, accommodation, meals and a visit to Alice Holt Research Station, will be £10 10*s.* for five nights, or £12 12*s.* for six nights. The study tour will cost about three times that amount. Applications should be made to the Chief Education Officer, Forestry Commission, 25 Savile Row, London, W.1., *not later than* 31 *July.*

Agricultural Exhibitions

England.—The Royal Show will be held this year in Cambridge from 4-9 July. Enquiries to the Secretary, Royal Agricultural Society of England, 35 Belgrave Sq., London, S.W.1.

Congo.—An International, Commercial, Industrial and Agricultural Exhibition has been planned from 8-23 July in Elizabethville. Information from the Secretary-General, Elizabethville International Fair, 2180 Avenue Leman (P.O. Box 1916), Elizabethville, Republic of Congo.

N. Rhodesia.—An Agricultural and Industrial Show will be held in Lusaka from 5-7 August. Particulars from Northern Rhodesia Agricultural Society, P.O. Box 333, Lusaka.

Australia.—An Agricultural and Industrial Exhibition will be held in Brisbane from 10-19 August. Particulars may be obtained from the Royal National Agricultural and Industrial Association, G.P.O. Box 122B, Brisbane, Queensland.

The Royal Agricultural Show is to be held in Perth, Australia, from 29 September-10 October. Details from the Royal Agricultural Society, 239 Adelaide Terrace, Perth.

New Publications

Rubber Planting

Manual of Rubber Planting (*Malaya*), 1960, by A. T. Edgar. Second edition. Pp. 705. Illus. The Incorporated Society of Planters, Malaya. Kuala Lumpur, Federation of Malaya. 1960. Price 63*s*.

First published in 1937 and reprinted 12 years later, this well-known book makes a welcome reappearance in a much revised and enlarged second edition, the preparation of which was spread over a number of years, necessitating repeated revisions and much extra writing. There is, in fact, much evidence of this time lag: the foreword and preface, for instance, refer to the 1958 manual, whereas the book is dated 1960, and a section is devoted to addenda, which is unfortunate in a book especially designed for speedy reference. The author reminds us that research on the cultivation and preparation of Hevea rubber has advanced during the post-war period to an extent and with a rapidity which has at times become almost bewildering. This, too, has added to the difficulties of a busy man in presenting a reasonably up-to-date manual on a subject of this magnitude.

Given more leisure, the author would doubtless have corrected the minor defects of this work. There is a lack of conformity in numbering figures and tables; rainfall is relegated to a small section at the end of the book instead of at the beginning, where it could more conveniently have been considered under the general heading of 'Climate'. In view of the fact that nearly half of the total area planted to rubber in Malaya is on smallholdings, it is surprising that no account is given of the smallholders' problems and the manner in which they are being solved by such methods as the special extension service for the supply of budded rubber. One must also regret that pests and diseases are not illustrated and that the bibliography is not more representative of the investigations on rubber carried out in Malaya.

These criticisms are, however, of a minor nature in relation to the wide scope of this book and the wealth of detailed information contained therein. The author covers every aspect of rubber production and its preparation for market, including ancillary subjects such as Malayan timbers, general information on concrete, bridges, stream training, surveying and public health, all of which come within the purview of the rubber planter.

Mr. Edgar writes with authority and gives the fruits of 40 years' practical experience of the rubber industry in Malaya, augmented by knowledge of the research work carried out by the Rubber Research Institute of Malaya and kindred bodies elsewhere. This knowledge of Malayan conditions is nowhere more evident than in one small section, where he gives a deeply penetrating and sympathetic account of the races of workers on estates in Malaya.

This manual will assuredly continue for many years to be the *vade-mecum* of rubber planters, not only in Malaya, but wherever rubber is cultivated.

D. H. GRIST

Exploration

Edited by S. Z. Ahmed. Published quarterly. 622 Ulster Chambers, 168 Regent Street, London, W.1. Price 14*s*. for four issues, including postage.

A greater knowledge of the unknown peoples of the world is a further step in the development of the aims and objects of WORLD CROPS and the advent of this new journal is therefore to be welcomed.

This magazine tells of the strange customs and beliefs of people living in remote areas of the earth and unravels the mysteries still hidden in the mountains, deserts and jungles. It recounts true stories of human hardship and achievement, as seen and recorded by anthropologists, geologists, archaeologists and explorers.

It is nicely produced and we wish the paper success.

W. LEONARD HILL

Outlook for Tea

Tea—Trends and Prospects. Commodity Bulletin Series, No. 30, published by FAO, Rome, 1960. Pp. 84. Obtainable from H. M. Stationery Office, P.O. Box 569, London, S.E.1. Price 5*s*.

This publication contains much that is of great interest and importance to the British tea industry, since it discusses the tea trade and its prospects in the broadest possible way. Many of the statistics quoted were supplied by the International Tea Committee.

The changes in tea areas and in yields since the war are detailed and possible reasons for the increase in the proportion of plain to quality teas are deduced. However, it should not be assumed that areas like those in Africa and the Argentine will always produce plain teas. The increase in quality from Assam estates has followed the replacement of the original stand by better types and similar changes can be effected in other countries.

In discussing present trends in tea consumption many interesting facts are disclosed, and these are correlated with three groups of countries: the high-income group, the Near East and North African countries, and the producing countries.

One section is devoted to an analysis of the demand for tea. In the high-income countries it is considered that wage increases will have no effect on *per caput* consumption, whereas in low-income countries a rise in wages or a fall in tea prices will increase consumption. This last is based on the results of the Indian Tea Survey of 1957.

International trade and prices are considered and conclusions are drawn with regard to prospects over the next five years. Thus the outlook is not disconcerting, but neither is it very encouraging, especially for common teas. This opinion is based largely on the possibility of a planned output from China of 840 million lb. in 1962. The output from that country in 1958 was claimed to be 311 million lb. Judging from the recent failure of agricultural plans in China, there would appear to be little chance of attaining such a target with a difficult crop like tea.

An appendix gives notes on tea culture in all the producing countries of the world and these are well worth study. Of particular interest is the account of trials in different parts of the U.S.S.R. These have ranged from the Trans-Carpathian region on the borders of Czechoslovakia, through the Crimea and northern Caucasian area, on to various parts of Central

Asia, and so to Vladivostok and Sakhalin on the Pacific. Apparently the first concern of the Soviet scientists is to find areas which are not insuperably adverse to tea growth, and secondly to evolve strains which are frost- and drought-resisting.

The concept of economic yields, fundamental to an economy based on markets and prices, plays only a secondary part in Soviet economy. Expressed in hard facts, the yield in Georgia, the most favourable area in the U.S.S.R., is only about 460 lb. tea per acre; in Assam yields of over 1,600 lb. fine tea are common.

C. R. HARLER

Bulletins and Reports

U.K. Ministry of Agriculture, Fisheries and Food. 'Silage'. Bulletin No. 37. 1961. Pp. 44. Obtainable from H.M. Stationery Office, P.O. Box 569, London, S.E.1. Price 3*s.* 6*d.*

Harper Adams Agricultural College. 'Measuring Output from Grassland in Terms of Animal Production' by M. Eddowes and R. Harris. Technical Bulletin No. 5. 1961. Pp. 20. Obtainable from the Bursar, Harper Adams Agricultural College, Newport, Shropshire. Price 3*s.* 6*d.*, including postage.

American Society for Horticultural Science. Proceedings of the Caribbean Region. VII Annual Meeting, Puerto Rico, 29 May-4 June. Volume 4. 1960. Pp. 108. Obtainable from E. H. Casseres, Inter-American Institute of Agricultural Sciences, O.A.S., c/o Londres 40, 2° piso, Mexico 6, D.F. Price $1.

Blackwell Scientific Publications Ltd. 'Herbicides and the Soil' by E. K. Woodford and G. R. Sagar. 1960. Pp. 88. Obtainable from Blackwell Scientific Publications Ltd., 24-25 Broad Street, Oxford, England. Price 17*s.* 6*d.*

Annual Reports

Empire Cotton Growing Corporation. Annual Report for 1960. Pp. 20. Obtainable from Empire Cotton Growing Corporation, 12 Chantrey House, Eccleston Street, London, S.W.1. Price not stated.

Rubber Producers' Council of Malaya. Annual Report for 1960. Pp. 27. Obtainable from the Rubber Producers' Council of Malaya, P.O. Box No. 272, Kuala Lumpur, Malaya. Price not stated.

American Potato Yearbook, 1961. Pp. 80. Obtainable from 8 Elm Street, Westfield, New Jersey, U.S.A. Price $2.

West African Institute for Oil Palm Research. Eighth Annual Report, 1959-60. Pp. 140. Obtainable from the Director, West African Institute for Oil Palm Research, near Benin City, Nigeria. Price 2*s.* 6*d.*

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East African Industrial Research Organisation. Annual Report for 1959-60. Obtainable from East African Industrial Research Organisation, P.O. Box No. 1587, Nairobi, Kenya. Price 2*s.*

The United Planting Association of Malaya. Fifty-ninth Annual Report, 1960. Pp. 64. Obtainable from the United Planting Association of Malaya, P.O. Box No. 272, Kuala Lumpur, Malaya. Price not stated.

University of Nottingham. Annual Report of the School of Agriculture, 1960. Pp. 100. Obtainable from University of Nottingham, Sutton Bonington, Loughborough, Leicestershire, England. Price not stated.

East Malling Research Station. Annual Report for 1960. Pp. 150. Obtainable from East Malling Research Station, near Maidstone, Kent, England. Price 17*s.* 6*d.* or $2.50.

FAO Publications

Report of the Symposium on Education and Training in Nutrition in Europe. Pp. 54. Price $0.50 or 2*s.* 6*d.*

Report of the European Seminar on Evaluation of Home Economics Extension Programmes. Pp. 50. Price $0.50 or 2*s.* 6*d.*

Review of the Agricultural Situation in Europe at the End of 1959. Pp. 180. Price $2 or 14*s.*

Review of the Agricultural Situation in Europe at the end of 1960. Pp. 135. Price $1 or 7*s.*

Rural Electrification. Vol. IV. Pp. 145. Illus. Price $1.25 or 9*s.*

Agricultural Mechanisation: 'Mechanisation of the Cultivation and Harvesting of Sugar Beet'. Pp. 54. Illus. Price $0.40 or 3*s.* 'Mechanisation of the Application of Chemical Fertilisers in the Form of Liquid'. Pp. 45. Illus. Price $0.50 or 3*s.* 6*d.*

Agricultural Engineering: Informal Working Bulletin No. 6, 'Methods and Machines for Tile and other Tube Drainage'. Pp. 45. Illus. Informal Working Bulletin No. 13, 'Methods and Machinery for Cutting and Cleaning Irrigation and Drainage Channels'. Pp. 35. Illus. Informal Working Bulletin No. 14, 'Safety Measures for the Use of Agricultural Machinery'. Pp. 44. Illus. Prices not stated.

Food and Agriculture Documentation Series, 1960. No. 29, 'Marketing of Fruit and Vegetables in Spain and Turkey'. Pp. 84. Price $1 or 6*s.* No. 30, 'Higher Education in Agriculture'. Pp. 142. Price $1.25 or 7*s.*

Food and Agricultural Legislation. Vol. IX, No. 2, December 1960. Three leaflets and index. A quarterly series published in three separate editions, English, French and Spanish. Subscription per copy (four issues) $3.50 or 17*s.* 6*d.* Price per single copy $1 or 5*s.*

All the above publications are obtainable from H.M. Stationery Office, P.O. Box No. 596, *London, S.E.*1, *or through local sales agents. Payment may also be made in local currencies.*

The new Blackwelder-U.C. tomato harvester moving through a field of ripe tomatoes in California. The combine cuts the plant at ground level and then separates the tomatoes from the vines and loose leaves, and delivers them into two sets of bins

Cultivating and Harvesting Machinery

Tomato Harvesting by Machine

The mechanical harvesting of tomatoes would at first sight appear to be a physical and economic impossibility because of the soft nature of the fruit and because they ripen unevenly, so that if all are harvested at the same time there would be a loss of about 25% of the harvest, besides a large percentage of spoilage by breakage and bruising.

The principle of tailoring the crop to the machine is being explored in the U.S.A., where Prof. G. C. Hanna, of the University of California, has produced a strain of tough-skinned tomatoes which will mature and ripen all at the same time so that a mechanical harvester can be used. If the 1961 plantings are successful, it is anticipated that this new variety will be planted generally in 1962. This research project has been financed by a grant-in-aid from the California Tomato Growers' Association and the Canners' League of California.

Simultaneously, Prof. C. Lorenzen and S. Sluka, of the same university, were developing the pilot model of a mechanical tomato harvester, also with a grant-in-aid from the Californian tomato growers, and after the initial work was done a licence to complete the experimental development and manufacture a mechanical harvester was negotiated with the *Blackwelder Mfg. Co.* by the Regents of the University.

This revolutionary new combine cuts off the plant tops at ground level, separates the vines from the fruits and delivers the crop into an accompanying trailer. The sequence of operations is as follows: A tine pick-up conveyor carries the plant tops up to a stripping device which removes the tomatoes from the vines. A shaking separator of rubber-covered 'walkers' delivers the stripped vines to the rear of the combine, while the fruits and loose leaves fall through on to a deleafing belt. The tomatoes then roll down on to the sorting conveyor, where they are picked over by two men and the two grades of fruit are conveyed into two sets of shallow trays built up in stacks and carried on a tractor-drawn trailer running parallel with the combine.

It is stated that the new machine, which is now in production, will pay for itself in labour-saving economies on all tomato farms of over 100 acres in extent and it is estimated that one harvester and 13 workers will be able to do the work of 60 men under the present back-breaking system of hand picking and collection.

Modern Rotary Tilling

The well-known L.150 has three different types of rotary tilling blades for the *Landmaster* system of cultivation: (1) Square foot blades for rotary harrowing and shallow digging in medium to light loam. (2) Curved foot blades for general rotary digging in medium loam. (3) Slasher blades for work in heavy soils and for rotary digging in conditions of heavy surface trash.

The need for alternative blades can be appreciated when it is realised that the shearing strength of a soil for a given moisture content varies from 4 lb. per sq. in. to 20 lb. per sq. in., which makes different power demands on the rotor. These blade forms allow

the available horse-power to be utilised to the full. These blades can be fitted to the machine to provide 10 different working widths from as narrow as 7½ in. up to 44 in.

Each type of blade assembly can be so controlled in speed of work to avoid over-pulverisation and breakdown of the soil structure, which influences the moisture content, aeration and temperature.

All-purpose Power Unit

An interesting all-purpose machine has been introduced by *Gebrueder Sturm*, of West Germany. It is a two-wheeled power unit, which is fitted with an air-cooled JLO 6-h.p., two-stroke engine and may be fitted with various implements for spraying, cultivating, hoeing, mounding, ploughing, mowing and harvesting; it can also be attached to a rubber-tyred two-wheel trailer and used as a utility truck for light haulage operations.

The Sturm two-wheeled power unit as fitted for rotary cultivation

Giant Disk Harrows

Irrigation and the use of modern farming methods have made it possible to transform the desert in the Imperial Valley of California into fertile fields. But the ground bakes hard in the arid heat and powerful machines are needed to break it up and prepare the soil for the crops—maize, melons, lettuce and other fruits and vegetables. In view of the size of the farms, large implements and tractors with plenty of pulling power are used to get through the work economically and quickly.

One huge implement used is the 18-ft., 48-disk *McCormick International* 'Una-Beam' harrow, which requires tractors of over 100 h.p. to pull it. One farmer, for instance, has a 134-h.p. TD-20 and a 105-h.p. TD-15 on his 2,000-acre property.

A giant pair of offset disk harrows used for covering large acreages in the Imperial Valley, California

The Minitractor

The 'Reyroto Minitractor' is claimed by its makers, *English Powerspades Ltd.*, to be the complete answer for the market gardener who wants one machine to do all his jobs throughout the year—two-furrow ploughing, ridging, disking, cultivating and raking. When so required it may also be converted into a self-propelled dumper. This power unit would thus appear to have dual possibilities — for cultivating between tea bushes and for bringing in the leaf.

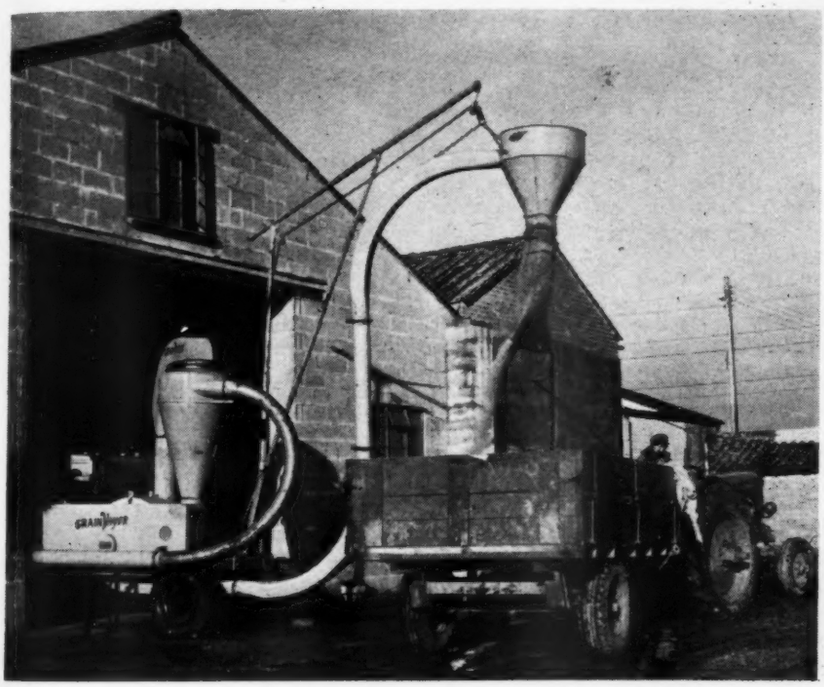
Grain Conveyor and Drier

The 'Grain Vayor', manufactured by *Conveyors (Readybuilt) Ltd.*, has been designed both for handling grain and for drying it, and it can also be used for drying baled hay. The unit is mounted on a four-wheeled chassis, is fitted with a towing attachment and is powered by a Lister HB3 diesel engine. The rated capacity is up to 12 tons per hour, depending on the length and arrangement of the ducting.

Its normal function is that of a pneumatic elevator and conveyor, but when the need arises it can be converted into a drier simply by disconnecting the ducting, fitting a drying nozzle and using the heat generated

by air compression in the turbine. Thus in a wet year, when grain or hay may need to be artificially dried, warm air can be blown into the bottom of the grain store or into the centre of a stack of baled hay.

Such a mobile conveying and elevating system has one obvious advantage over a fixed installation in that only one unit is required and this may be moved from farm to farm; in addition, no special modification of the farm buildings is necessary. The grain may be brought by lorry from the combine harvester and delivered either to the top of a storage silo or on to the floor of the barn and later it may be used again to suck up grain from the floor of the barn and lift it into the lorry for delivery to the flour mill.



The 'GrainVayor' set up to feed the grain into a trailer for local delivery

The Catchpole 'Cadet' sugar-beet harvester for side-delivery

A new attachment to the Servis 'Gyro 84' cutter ensures perfect windrows

Windrow Attachment

For several years the Servis 'Gyro 84' cutter has been used for cutting hay to be raked up into windrows later.

The *Servis Equipment Co.* has gone a step further by perfecting a windrowing attachment which affords a 7-ft. cutting swath that ensures that the hay is properly conditioned in the process and placed in uniform windrows. The hay is cut into proper lengths for ease of handling by the baler which follows.

According to the manufacturer, this implement may now be used for pasture maintenance, brush cutting, row crop and stubble shredding, grass mowing and for cutting and windrowing hay in a single operation.

Harvesting Sugar-Beet

The new 'Oppel' lifting wheels of the *Catchpole* side-elevator sugar-beet harvester are designed to draw the roots out of the ground in a clean undamaged condition. The plants are elevated on an open chain conveyor, the tops are spread over the ground ready for ploughing in and the cleaned roots are delivered into a trailer travelling alongside.

Two Power Units for Cultivation

Hako Hans Koch & Son produce two interesting power units — the 3-h.p. (75-c.c.) Hako 'Combinette' and the 4.3-h.p. 'Hakorette'. The lighter and smaller machine—a monowheel—is particularly useful for work between

Left: *View of drive with guards removed. Four V-belts are fitted and the pulley rims can be interchanged to vary the relationship of p.t.-o. and drum speeds. The multi-purpose screw jack is in the position which it occupies when the machine is in work.* Right: *Our representative operating the new 'Hurricane' on a 6-in. ley. The swivelling of the delivery chute and the adjustment of the deflector hood during harvesting was quite an easy matter*

close-spaced rows and for lifting to higher levels in terraced plantations and is recommended by the makers for ridging potatoes, hoeing turnips and high-speed cultivations.

The more powerful machine can be used either with one or two wheels. It has great manœuvrability and a multiplicity of uses—as a light mower, as a snow plough, as a tined hoe and as a rotary cultivator, as a plough and potato ridger and finally as a light transporter. The guide handles are adjustable vertically, laterally and for length.

It is recommended by the makers for use in market gardens, in vineyards, in forests and on agricultural stations.

New Silage Harvester

Time and motion study has contributed to making it a pleasure to operate the off-set 'Hurricane' harvester recently introduced by *David Brown Tractors Ltd.* This was the verdict of our representative when he carried out a lengthy test of the machine at Losely Park in Surrey. He found that all the controls were within easy reach or could be adjusted to suit his convenience and that every operation in the harvesting cycle could be seen and full control could be exercised without having to leave his seat on the tractor.

Perhaps the most outstanding technical achievement in the design of this machine is the introduction of a free-floating cutter unit, which is carried on a hinged mounting well to the rear of the drawbar. This ensures that the cutter bar follows the ground contours at a predetermined height, and this is hydraulically adjustable between 2 and 8 in.

A semi-automatic change-over will convert the harvester from the off-set cutting position to the in-line position for movement through gates or along the road. All our driver had to do was to pull a trip rope while the machine was moving forward. Conversely, backward movement and another pull on the trip rope caused the harvester to move from the line astern to the off-set position ready for work.

A screw jack which is carried on the machine has three separate functions: it can be used to support the harvester during coupling or uncoupling; in operation it acts as an adjustable control of the minimum cutting height; and when requiring to vary the position of either of the wheels of the harvester the jack can be used to raise one wheel clear of the ground.

There is a straight-through drawbar which links the tractor to the trailer and this ensures that the harvester does not have to take any of the strain due to the weight and drag of a heavily loaded trailer.

Improved Sugar-Beet Harvesting

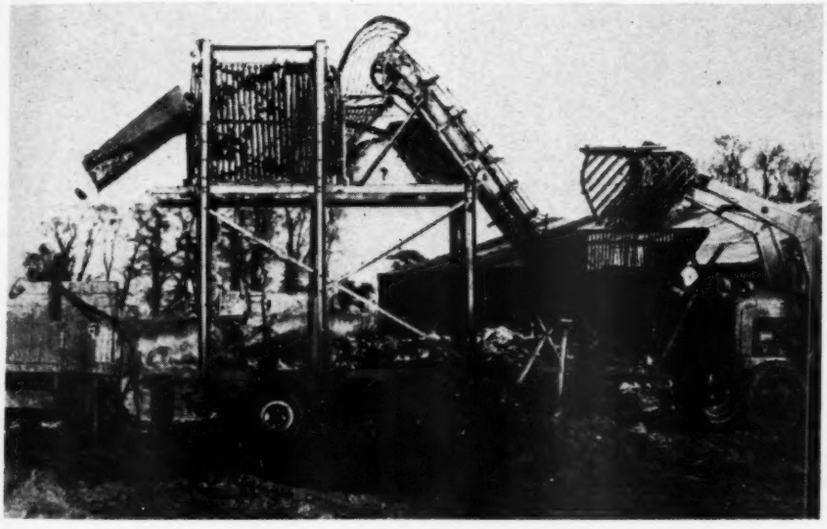
The cleaner-loader has become a standard item of harvesting equipment wherever the problem of delivering sugar-beet to the factory in a reasonably clean condition presents itself. The problem is far worse in some places than in others and is particularly severe on heavy-land farms in low-lying areas, such as the fenlands of East Anglia.

The revolving-cage type of cleaners are generally too low-based and there is in consequence too little room under the machine for the discarded dirt to accumulate. The result is that it may have to be moved several times to fresh sites in the course of a working day.

This time-wasting fault has been corrected in a new type of cleaner-loader which was severely tested on a

number of farms in Norfolk during the wettest autumn of the century. In appalling conditions, it reduced the tare of adhering dirt from 27 lb. per cwt. down to 14 lb. per cwt.; otherwise expressed, from the roots harvested from 80 acres it removed 223 tons of soil, which remained on the farm instead of being carted to the factory, where it would definitely be an embarrassment.

Apart from the cost of needless transport, the loss of three tons of valuable topsoil from every acre every three or four years is obviously a serious matter. In short, wherever the dirt tare is normally over 20 lb. per cwt. the use of such an efficient cleaner-loader would amply justify its capital cost.



Pointer's sugar-beet cleaner operating in appalling conditions on a farm in Norfolk

The new machine, which is now being produced by *Pointer's Transport Services Ltd.*, has two unique features: the cleaning cage revolves 10 ft. above ground level, so leaving room below for the accumulation of 20 tons of dirt; and the cage has a new type of cleaning mesh which spirals the roots through the cage in a divided stream and not in a mass, so that each root receives individual treatment. The unit, which includes a capacious loading hopper, an open-type elevator and a delivery chute, adjustable for lorry height, is mounted on four wheels and can be moved in a very small space.

Multi-purpose Cultivator

A short account of the 'Superflow' cultivator was given on page 76 of our February issue. Since then further information has been received regarding its use for various purposes, which indicate that it will have important applications in tropical conditions for breaking up and preparing hard ground for cotton, sugar and sisal.

A demonstration was recently carried out on an area of barley stubble; the soil consisted of 9 in. of chalky loam overlying chalk; and the five main applications of the 'Superflow' system were shown. These were *subsoiling* to a depth of 12-14 in., using two tines on the frame, which was drawn by a *David Brown* '950 Implematic' tractor; *pan busting* with three tines working at 10-12 in. depth behind a *Massey-Ferguson* '35' tractor; *chisel ploughing* with five tines, using the *International* B275, and covering the ground three times as fast as when mouldboard ploughing; a second run, diagonally, left the ground in a well-broken condition for weathering.

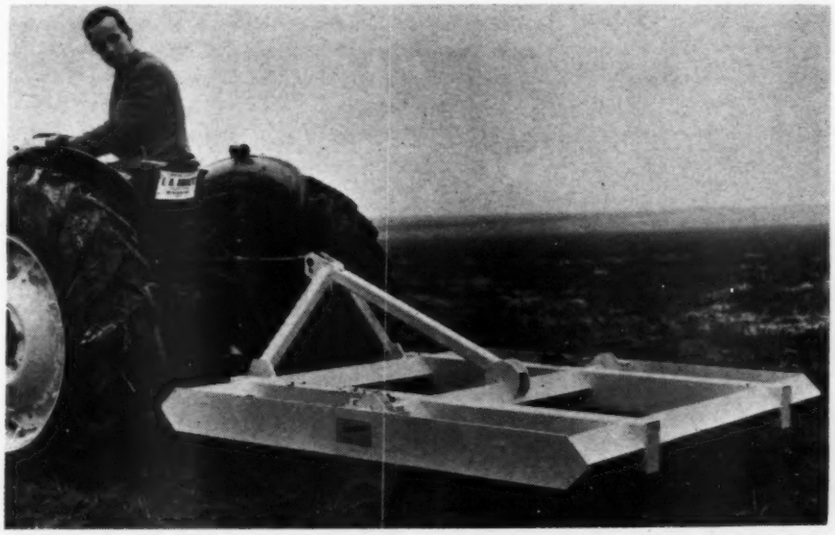
Stubble cleaning, using seven tines, two depth wheels and a *Nuffield* Universal DM4 tractor, provided an excellent after-harvest operation. Finally, the full complement of nine tines was used behind a *Fordson* 'Super Major' to effect *full cultivation* in a single pass. This operation demonstrated the positive penetration of the 'Superflow' system.

The size of the tilth produced by the implement can thus be graded by varying the number of tines fitted to the frame and by the speed of the tractor, so that it is possible to leave a heavy cloddy tilth where soil erosion is liable to occur or any intermediate condition down to a fine tilth for the seedbed.

Mobile Self-Feeder

Silorators Ltd. have a forage wagon which can be used both as a self-unloading silage trailer and as a mobile self-feeding unit for zero-grazing (in which the grass is brought to the animals instead of the animals being taken to the grass with consequent damage by 'puddling' and dung droppings).

It consists of the basic 'Auto-Drop' forage wagon chassis fitted with a 12-ft. x 6-ft. low-loading platform, a central ridge and feeding barriers for 18 head of cattle. One load of green crop will provide a morning's feed for about 60 head of cattle.



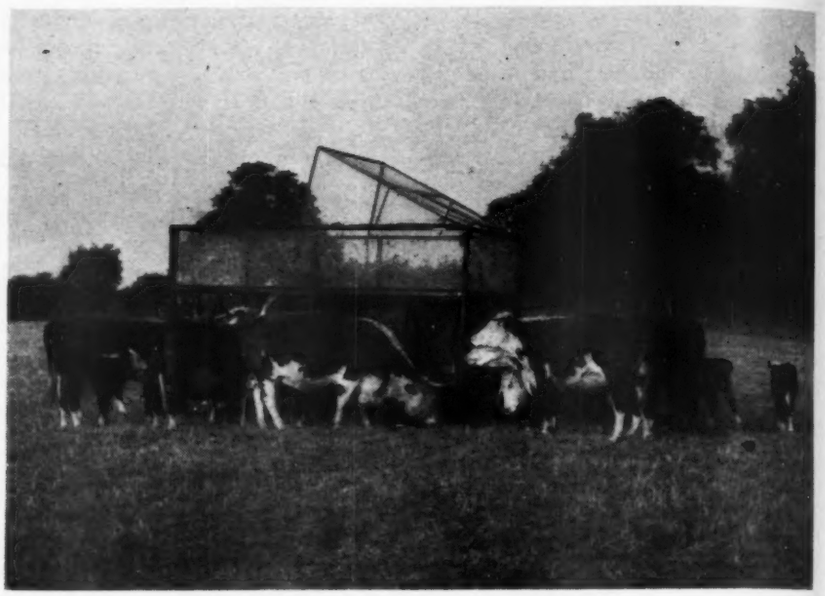
Subsoiling with two tines fitted to the 'Superflow' cultivator by Bomford & Evershed.

Adjustable Farm Gates

The prefabricated *Clay* stock gate, produced in the U.S.A., is of all-steel construction with adjustable hinges and 'U' channel steel crossbars. The clamp-type hinges make it possible to fit the gate at any level and raise or lower it without resetting the hinge pins. Besides its rigidity and strength, the smooth steel will not injure the animals. The gate is available with four, five or six panels and in lengths from 8-18 ft.

A Correction

It was incorrectly stated on page 202 of our May issue that the Organizzone Apis introduced the Samecar. Actually this ingenious tractor-cum-lorry is being manufactured and sold by *Same-F Cassani & C.* of Italy.



The Silorator forage wagon being used as a mobile self-feeding unit for zero-grazing

Harvesting Almonds

T. A. DICKINSON

AN almond grower in California, U.S.A., has invented two machines for harvesting nuts. One is a tree-shaker and the other is a cleaner and collector of the fallen nuts.

The shaker is a three-wheeled machine which carries a horizontal steel boom, a petrol engine, an air compressor and the operator. The boom carries a collar which is clamped to the tree and is vibrated by compressed air. The inventor claims that the machine will do the work of five men beating the foliage with poles.

The harvester is simply a tractor-mounted vacuum cleaner and elevator. It sucks up fallen nuts and transfers them to a mesh-type elevator. Loose dirt is shaken off and falls through the mesh of the conveyor and the cleaned nuts are thrown into a trailer towed by the same tractor.

It is claimed that, besides saving labour, these machines prevent spoilage, as the nuts can be shaken down and picked up before they can rot or become insect-infested.

Left: *The Godde tree shaker is mounted on a three-wheel transporter and operates by compressed air.* Right: *The Godde nut collector consists of a vacuum hood and a conveyor*

Agricultural Chemicals and Supplies

For Low-volume Spraying

When the usual formulations of insecticides or fungicides are applied in low volume (1-2 gal. per acre), from aircraft or by drift spraying or mist-blowing, the fine droplets are liable to evaporate before reaching the crop. The initial retention of the spray on the foliage is thus drastically reduced and, furthermore, the proportion of the spray which does adhere to the crop is easily removed by rain, or even by wind. Some of these problems can be dealt with by applying the active ingredient in an oil or oily formulations, but the phytotoxicity of the oil may raise a new problem.

The 'Lovo' formulant principle has been developed by *Fisons Pest Control Ltd.* to overcome these difficulties. They are based on amine stearates and produce a film of stearic acid round each spray droplet as soon as it is formed by evaporation of the volatile amine base. It is claimed that the film which is thus produced has a four-fold effect: water evaporation is retarded before the spray reaches the crop; the retention of the spray on hard-to-wet surfaces (such as banana leaves) is improved, so giving better coverage; the resistance of the spray deposit to rain is improved; and in some cases a reduction of the dosage of active materials per acre is possible without loss of efficiency. The formulants are said to be non-phytotoxic, non-corrosive, non-hazardous in use and good suspending agents for the insoluble active ingredients with which they may be used.

Trials are still being carried out on the use of these formulants with various active ingredients on different crops in many parts of the world. So far tests have shown that 'Lovo' has been particularly successful with copper-oxychloride, mixtures of maneb or zineb with copper-oxychloride, 'Sevin' and the spores of *Bacillus thuringiensis*, which are particularly difficult to formulate.

'Lovo 190' is considered the most suitable formulation for use with insecticides in the tropics, as it is highly concentrated; for temperate climates 'Novo 192' is recommended, as it has added alcohols as anti-freeze agents.

Pot trials with brussels sprouts. The two plants on the left were treated with 'Crag Sevin' and the two on the right with 'Crag Sevin' and 'Lovo'. The two plants in the foreground were subjected to artificial rain, demonstrating the superior sticking power of the 'Crag Sevin' when used with 'Lovo'

'Lovo 179' is intended for use with fungicides. Further information on these formulants may be obtained through our Reader Service.

Controlling Water Weeds

A herbicide for the control of emergent water weeds, such as reeds, rushes and sedges is offered by *Borax Consolidated Ltd.* This water-soluble powder, 'Dalacide', has two active ingredients—sodium 2,2-dichloropropionate (dalapon) and sodium 2,2,3-trichloropropionate.

'Dalacide' solutions are applied during a period of active growth as a fine spray to give a complete coverage of leaf surfaces without excessive run-off. The most satisfactory coverage is given by constant pressure sprayers, which deliver a fine droplet without undue misting. The chemical is gradually absorbed by the leaves and moves down into the root system; the sodium salt or amine of 2,4-D is compatible with 'Dalacide' and at 2-4 lb. per acre can give useful control of broad-leaf weeds, such as fool's cress, watercress, waterdock, water forget-me-not and water plantain.

The manufacturers warn users that the product can damage all types of vegetation and its application should therefore be confined to the particular weed which is to be controlled. Although the chemical is relatively non-toxic to livestock, cattle should not be allowed to graze on freshly sprayed vegetation to avoid the possibility of residues in milk or meat.

Modern Silage Making

'Modern Silage Making'. Film by Pan Britannica Industries Ltd.

This film sets out to explain the system of making 'cold fermentation' silage and to compare it with the old method of 'heating up'. The example of three neighbouring farmers who use different silage-making methods is shown, as well as a series of charts and diagrams to illustrate good and bad silage.

The lesson of the film is that the 'cold fermentation' method, using a chemical additive to replace air, does

away with delays and reduces nutrient loss. The basis of this system is to fill the silo rapidly with a chopped crop, which is then firmly consolidated to drive out air and the silo is sealed immediately. If the crop is leafy, a chemical additive is essential. The producers of the film advocate the use of their chemical, 'Kylage', to inhibit the spoiling bacteria and to stimulate the lactic acid producers.

Protective Aprons

A new range of bib-type aprons is announced by a firm of manufacturers of protective clothing. Made from 'Hydex' lightweight, nylon - based, PVC-coated material manufactured by *I.C.I.*, these aprons are only half the weight of other types of protective aprons. Though lighter in weight than equivalent areas of cotton or rayon, the material is many times stronger and has excellent flex life over a wide range of temperatures. Due to the use of a synthetic base fabric, it is rot-resisting, non-absorbent and absolutely waterproof. In addition, it is resistant to a wide range of chemicals.

The aprons, produced by *Jeltek*, are available in two sizes—24 in. x 34 in. and 36 in. x 42 in.

Carrot Seed Dressings

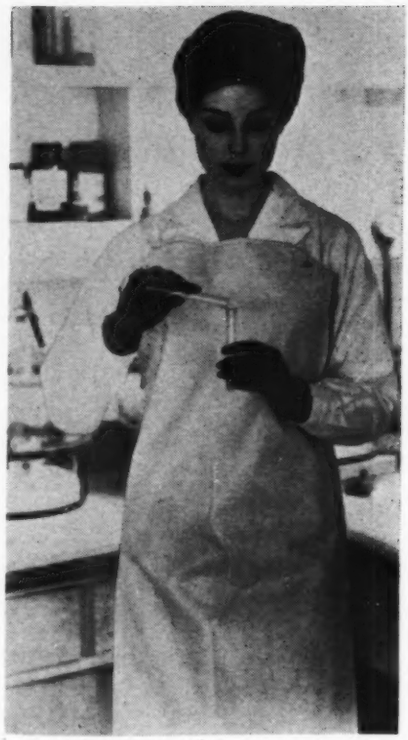
Attacks by carrot fly can rapidly reduce a crop, but these can be prevented quite easily and cheaply by the use of a suitable seed dressing, *i.e.* one that has high powers of adherence and so does not rub off easily during handling, that does not affect the germination of the seed, and that does not produce a taint in the crop.

The use of 'Lindex' seed dressings, according to the *Murphy Chemical Co. Ltd.*, will give good protection for from six to eight weeks, the time depending on the nature of the soil, for they do not remain as effective quite as long on peaty fen soils as on mineral soils, such as sand, sandy clay and clay.

It has been found that there may be a residual taint in carrots grown on mineral soils and in such cases the use of their dieldrin seed dressing is recommended instead.

Harmless Haulm Killer

Following the decision taken last year by manufacturers of agricultural chemicals to cease manufacture of



Bib-type protective apron which is waterproof, rot-resisting and also resistant to a wide range of chemicals

sodium/potassium arsenite potato haulm killers, *Shell Chemical Co. Ltd.* have now introduced a new haulm destroyer, which is called 'Holtox'.

The new product is harmless to man, stock and game; it is non-corrosive, non-tainting and has such short persistence in the soil that the ground can be replanted only 14 days after spraying.

The product can be applied in any low-volume spraying equipment and protective clothing is not necessary because the product is non-toxic. Leaf kill can be expected within 3-4 days and there is complete desiccation of the haulm in 12-14 days.

Reader Service

For further information on any item reviewed in this issue please use the card provided or write to:

Reader Service,

World Crops,

Leonard Hill House,

Eden Street, London, N.W.1

England

For Broad-Leaved Weeds

'Mecopon' is the name of a new broad-leaved selective weedkiller to be marketed by *Dow Agrochemicals Ltd.* This is a formulation based on CMPP and silvex. 'Mecopon' will not sterilise the soil, is non-poisonous and can be applied by low-volume sprayer. There is also no need to wear protective clothing during application.

Because 'Mecopon' controls such arable pests as charlock, fat hen, orache, buttercup, docks, poppy, wild radish, annual neetle and creeping thistle, it is of considerable value as a safe alternative to the poisonous chemicals formerly used. Notably, also, it controls cleavers and chickweed, which resist chemicals of the MCPA group.

Seaweed Soil Conditioner

A new soil conditioner has been developed by *Oxford Horticultural Laboratories Ltd.*, who claim that its application will bring soil up to optimum condition for cultivation. The new product — 'Alginure' — is made from seaweed and contains sodium alginate, which has long been recognised as an excellent, though rather expensive, soil conditioner.

This new organic compound acts by breaking up clay soils into crumbs or by binding fine sandy soils into crumbs which can better hold water and plant food; it thus has a potential use in soil erosion projects and the reclamation of desert lands.

At present it is being produced for the U.K. home gardener either as a compost activator or a foliar spray. The manufacturers stress that the product is not a fertiliser, and that the usual dressings of plant food, either organic or inorganic, must be applied, although they will be more effective when used in conjunction with 'Alginure'.

Land Reclamation

In the item under this heading on page 203 of our May issue, it was stated that *Baywood Chemicals Ltd.* were the distributors of 'Econal'.

It has been pointed out by the manufacturers that Baywood Chemicals Ltd. are their distributors to the farmer in the U.K. only and that all trade and export inquiries should be addressed to *Burt, Boulton & Haywood Ltd.*

World Crop Reports

INTERNATIONAL REPORTS

Flax

World flaxseed production in 1960 is estimated at 130 million bushels, 7% more than in 1959 and almost one-fifth larger than the 1950-54 average.

The estimated gain from the previous year, almost 8 million bushels, is mainly the result of increases in the U.S.A. and Canada, which were only partially offset by the decline in Argentina and a lesser drop in India. There were relatively substantial increases in Uruguay and Brazil.

North American production exceeded the 1959 out-turn by well over one-third. Canada's crop at 25.1 million bushels was 42% larger than the relatively small out-turn of the previous year and was surpassed only by the record 34.5 million bushels of 1956 and the 26.1 million bushels of 1912. Flaxseed acreage increased one-third from a year earlier, and yields rose sharply. Furthermore, the quality and condition of the crop were excellent.

U.S. production at 31.1 million bushels also was 42% larger than 1959, but almost one-sixth below the 1950-54 average. Acreage rose by 14% and yields averaged 1.8 bushels per acre more than in the previous year.

Flaxseed production in South America declined by a quarter because of the sharp reduction in the Argentine crop. The second official estimate placed Argentina's harvest at 22.4 million bushels, one-third below 1959, but a quarter more than the 1950-54 average. Area planted declined moderately from 1959 and yields varied widely, depending upon the extent of the drought during May-July in various major producing provinces.

First official estimates of Uruguay's crop reflect an increase of one-fifth in planted acreage and higher yields providing a crop half again as large as a year earlier. Similarly in Brazil, preliminary estimates indicate that acreage expanded about one-third and production rose by about one-half. Acreage expansion in Brazil was due primarily to reduced wheat plantings and sharply increased prices for flaxseed and linseed oil. In Chile, production was expected to be up mainly because of the 10% rise in acreage, due principally to the change from crops, such as rice and sunflower seed, to flaxseed, for which farmers expected to receive a higher net return.

The sharp increase estimated for *European* flaxseed production is largely in the western area—specifically in the Netherlands, Belgium and France. The crop in U.S.S.R. may not have varied greatly from the officially estimated 15.6 million bushel out-turn of 1959. Acreage is believed to have been slightly larger than the 4.6 million acres of 1959, but unfavourable weather probably reduced yields.

Some decline occurred in the relatively small quantity of flaxseed produced in *Africa*. Output in Ethiopia, the major producing country, probably did not vary greatly from the 1.3 million bushels harvested in 1959. However, the drop in Morocco's production exceeded the increase in Egypt.

Asia's 1960 production declined an estimated 5%, reflecting smaller crops in India, Turkey and Iran. India's 17 million-bushel crop was 5% less than the previous year's out-turn as a result of a slight reduction in acreage and less favourable weather. Turkey's crop also declined moderately from a year earlier, and Iran's was down 14%.

In *Oceania*, flaxseed production probably fell moderately short of the previous year's level. Australia's crop was somewhat better than indicated earlier, but because of dry conditions in Queensland it was still below 1959 (see also page 254).

Cacao

The latest estimate of the 1960-61 *world cacao bean production is* 2,530 *million lb. This surpasses the* 1959-60 *record of* 2,233 *million lb. by* 13%.

The 1960-61 *North American* crop is estimated at 188 million lb., compared with 189 million in 1959-60. Most of these countries showed little change in production from 1959-60.

The 1960-61 cacao crop in *Costa Rica* is estimated to be slightly above 1959-60, despite some losses due to heavy rains in the Limon and Sixaola areas.

Cuba's 1960-61 production is estimated at 6 million lb., slightly less than the 6.3 million lb. of 1959-60. The *Dominican Republic* crop is expected to be slightly smaller than the previous year. *Mexico's* cacao bean production will probably be slightly higher.

South American 1960-61 cacao bean output is estimated at 508 million lb., 8% lower than 1959-60. The only sizable drop, however, is in *Brazil*, where the Bahian main crop was much reduced due to pod rot. The Temporao (May-September 1961) crop is also expected to be below normal. Damage from strong winds and heavy rains about mid-1960 are said to be primarily responsible.

Colombia's 1960-61 cacao bean crop is estimated at 31.5 million lb., compared to 31.3 million in 1959-60. The campaign to expand cacao production was placed under the Ministry of Agriculture on 1 January, 1960. The aim is to plant 800,000 new cacao trees annually for about 10 years to reach a total planted area of 13,000 ha., and also to rehabilitate 18 million trees now on 30,000 ha. (1 ha. = 2.47 acres).

Ecuador's losses due to Monilia Pod Rot this year have been insignificant, as the weather was very dry. The crop matured earlier than usual and arrivals of cacao on the market have been much above the previous year.

Peru's cacao production has doubled in the last 10 years. The 1960-61 crop is estimated at a record 8 million lb. *Venezuela's* crop probably will be little changed.

Total 1960-61 cacao bean production in *Africa* is estimated at 1,740 million lb., compared with 1,450 million in 1959-60. Several major producers will have record crops because of favourable weather and improved spray programmes.

Cameroun production, almost completely by small cultivators, is increasing under a Government programme for expanding and improving cultivation practices. Cacao is produced in the southern part of the country, except in the coastal areas.

The crop in *Ghana*, the largest world producer, is far exceeding any previous crop this year. Exceptionally favourable weather and a rigid capsid spraying programme are contributing to the large out-turn. Ghana's 1960-61

crop will account for about 36% of world production.

The 1960-61 crop in the *Ivory Coast* is estimated at 190 million lb., compared with a 1959-60 crop of 128 million. Production in *Fernando Po* and *Rio Muni* for 1960-61 is expected to total 55 million lb., with 20 million lb. forecast for *Sao Thome* and *Principe*.

Nigeria, with a record crop this year, has passed Brazil for second place in world cacao production. Black pod and capsid damage have been small and weather was particularly favourable.

The 1960-61 cacao bean production in *Asia* and *Oceania* is estimated at 49 million lb., 12% higher than the 43.6 million lb. of 1959-60. Some increases are expected in most of the producing countries. Output is rising rapidly in *Papua* and *New Guinea*. Strong winds and heavy rains hurt the current cacao crop in the *Philippines*.

REGIONAL REPORTS

Denmark

Danish production of *oilseeds* was expected to exceed 26,000 m. tons in 1960. The increase of nearly one-third over 1959 production is due to a 50% expansion of *rapeseed* and *mustard seed* acreage. *Flaxseed* production this year is expected to be only slightly larger than last season.

In spite of the sharp rise in domestic oilseed production, output will still be only about 5% of total supplies, since imports of oilseeds, particularly soya beans, were expected to be stepped up considerably in 1960.

Pakistan

In 1961, sufficient *jute* seed will be available in Pakistan to plant 1.8 million acres—an area 30% larger than the 1.4 million acres harvested in 1960, when drought severely reduced acreage. The 1960 crop, which, according to the final estimates, was 2,250 million lb., was barely adequate to meet demand.

Yugoslavia

The 1960-61 *cotton* crop is estimated at 14,000 bales, compared with 13,000 bales last season and an annual average of 12,000 during the past five seasons. A substantial expansion of cotton production is planned when irrigation and drainage facilities are completed. However, relatively unfavourable climatic conditions and keen competition from other crops tend to hold down rapid production increases.

Nigeria

Nigeria's 1959–60 *cotton* crop is estimated at around 150,000 bales (500 lb. gross) which is 6% less than in the previous season. This decline is attributed mainly to insufficient rain, particularly in the northern region where most of Nigeria's cotton is grown. Cotton acreage for 1959–60 is estimated at 800,000 acres, about the same as in 1958–59

Brazil

Brazil's 1961 production of *castor beans* is expected to equal the record crop of last year. The weather will greatly influence the yield, but high bean prices could also increase the acreage planted to castor.

According to Brazilian trade estimates, 1960 production was 226,000 short tons, an 18% increase from the 1957-59 average of about 191,000. The remainder of beans from the 1960 crop is expected to keep the crushing industry busy through June.

Mexico

Mexico's *groundnut* acreage in 1961 is expected to increase to 173,000 acres from 160,615 in 1960 and 148,260 in 1959. Production is forecast at about 90,000 short tons, compared with 77,000 and 83,000 in 1960 and 1959 respectively.

Despite the acreage increased last year, production declined moderately because of drought.

Egypt

Egyptian *groundnut* production in 1961 may be close to 40,000 short tons, compared with 38,690 last year. This estimate is based on use of 44,000 acres and a normal yield. In 1960 42,735 acres were planted. The small upward trend in production in recent years is mainly due to the desert reclamation programme now in operation.

Groundnuts are Egypt's fourth largest export crop. Shipments in 1960 totalled 14,262 tons (3,031 tons shelled and 11,231 unshelled), compared with 13,672 tons (2,468 shelled and 11,204 unshelled) exported in 1959. About one-third of the unshelled nuts went to Czechoslovakia and one-quarter to Switzerland. Most of the shelled nuts went to Canada, Lebanon and Switzerland.

Argentina

Argentine *flaxseed* acreage this year is smaller than in 1959 by 7%, or 205,000 acres. The decline apparently is the result of drought during May, June and July and of increased competition from livestock for the land.

The new flaxseed crop is reported to be doing well. However, yields would have to be exceptionally high to equal the 32.9 million bushels produced in 1959-60, when yields were unusually good. In any case, the new crop is likely to be larger than the nearly 25-million-bushel average which was maintained from 1956 to 1958.

Lebanon

The Lebanese *tobacco* crop totalled 7.9 million lb. in 1960, compared with 7.7 million in 1959. Most of Lebanon's tobacco is Oriental-type leaf for cigarette manufacture. As an expansion in tobacco acreage is planned for next year, the 1961 crop should be substantially larger than this year's harvest, which was reduced by drought.

Nicaragua

The 1960-61 *cotton* crop in Nicaragua is estimated at about 130,000 bales (500 lb. gross). Heavy rains in the autumn led to a reduction in earlier estimates.

The present forecast is slightly larger than the 1959-60 crop of 128,000 bales, but is about 30% under the annual average of 184,000 bales during the past five seasons.

Acreage harvested this season will probably be slightly smaller than the 164,000 in 1959-60, and well under the five-year average of 206,000.

Jamaica

The latest estimate of Jamaica's 1961 sugar production is 454,700 tons and indications are that this might be a record year.

Up to April 239,383 tons of sugar from the 1961 crop had been manufactured.

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